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Murphy Acts as Mediator

When Strike Settled, Work Will Resume in Less Time than Ever Before, Says Knudsen

The General Motors strike has thrown 115,000 of the corporation's employes out of work and probably another 35,000 employes of suppliers with a total daily wage loss of at least $1,000,000, W. S. Knudsen estimated late Wednesday in a press conference.

Knudsen had just replied to the governor's invitation to meet with him and union leaders in Lansing Thursday. He said he was going to meet the governor with an open mind. "I am going to see him in good faith, as one should when he goes to see the head of the state," he declared. The corporation, however, he added, would adhere to its position that plants would have to be evacuated of strikers before negotiations would begin.

Asked if he would prefer presidential intervention, Knudsen said: "That is up to the President. I wouldn't ask for it as long as the governor has the matter in hand."

Mr. Knudsen would not estimate how much the corporation was losing because of the strike. "I hate to think of it," was his comment. He said that when the strike is settled the plants will get going again in a shorter time than ever before." explaining that the divisions had banks of finished materials which could be thrown into production promptly. He was not worried particularly about the glass supply, saying: "We are not down for glass. We can make a start."

Discussing collective bargaining, Knudsen acknowledged that four of the union's demands might properly be

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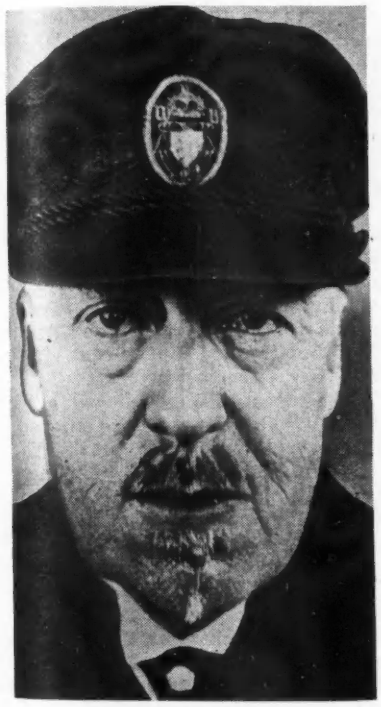

Dr. Hugo Eckener chairman of the board, Zeppelin Transport Co., who spoke at the SAE dinner in Detroit, Jan. 14

SAE Annual Meeting

New Officers Elected; 40 Papers Heard by Large Gathering

Election of Harry T. Woolson, Chrysler executive engineer, as president of the Society of Automotive Engineers was announced this week at the annual meeting of the society, held in Detroit. Election of nine vice-presidents representing professional activities of the society and of new councilors was also announced. (S.A.E. officers elected were those nominated last September, complete list of which appeared on page 427 of AUTOMOTIVE INDUSTRIES, Oct. 3, 1936.)

Forty papers and addresses were presented at 20 sessions, and registration of members and guests is estimated to have exceeded a thousand. Nearly 1400 persons attended the Detroit Section's banquet Thursday even-

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Half-Million in Dec.

Total Vehicle Production for 1936 Estimated Over 4,600,000

By Harold E. Gronseth

But for the strike that has cut General Motors' production to one-third of normal volume and, by the end of the coming week if not settled, will have completely stopped assembly operations of all divisions, the automobile industry now would be turning out more vehicles than at any time since the record year 1929. Schedules set up for the current month indicate output

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Governor Frank Murphy, of Michigan (left), explains to W. S. Knudsen, GM's executive vice-president, his efforts to mediate the strike

International News photo

Trailer Makers Ask Uniform Laws

Recommend Separate Registrations and Size and Weight Limits; Propose Interstate Reciprocity

An appeal to state legislatures for recognition of the trailer coach as a vehicle demanding a separate classification for purposes of registration, is one of several recommendations that are being prepared by the Trailer Coach Manufacturers Association.

The recommendations, involving 12 specific issues, are designed to assist legislators in amending motor vehicle acts in order that uniform legislation may be obtained to permit sale and use of the trailer coach on the highways, and for the benefit of trailer coach owners.

Pertinent among the issues which the association has advanced is the fact that the trailer coach cannot be construed as a permanent place of abode for reasons of its mobility, and inasmuch as it does not generally provide the space and facilities usually associated with American home life. A second important point is the recommendation that all states extend full and complete reciprocity to all other states so far as operation of the coach trailer is concerned. The association recommends a registration fee based on 25 cents per 100 lb. of weight.

Summarized, the 12 points set forth by the association are as follows:

1. That the trailer coach be recognized as a vehicle and be given a separate classification for registration, based on 25 cents per 100 lb. of weight.
2. The overall width be limited so as not to exceed 96 in. and the overall length limited so as not to exceed 13 ft.
3. That the towing car and trailer shall be considered as a unit when properly coupled together, and that their combined lengths shall not exceed 45 ft.
4. That all trailer coaches weighing 1000 lb. or more shall be equipped with brakes, adequate to stop such vehicle when traveling at 20 m.p.h. within a distance of 30 ft., and that the brakes shall be subject to control by the driver.
5. That all trailer coaches be equipped with marker lights that may be seen from a distance of at least 200 ft. in ordinary visibility, said lights to be located at each of the four upper outside corners; with two green lights visible at the front and two red lights at the rear, and in addition there shall be a combination tail and stop light which shall be controlled from the driver's seat.
6. That all trailers shall be equipped with 110-volt wiring systems, with approved Underwriters' Laboratories wire used throughout.
7. That all trailers shall be identified by a plate bearing the factory serial number.
8. All pull cars shall be equipped with rear vision mirrors of approved type giving clear vision.

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AMA Shipments Break Records

December Volume of 389,382 Best in History for That Month—191% Above 5-Year Average

With December factory sales at an all-time peak for the month, members of the Automobile Manufacturers Association completed 1936 with a total aggregate volume for the year of 3,512,436 units, it was disclosed in the regular monthly report of the association.

Shipments of members in December amounted to 389,382 cars and trucks, the association reported. This was not only 14 per cent above the November volume and 21 per cent above shipments for the corresponding month of 1935 but it was 191 per cent above the five-year December average.

The report also established that members of the association enjoyed the largest volume of last quarter factory sales in their history. Shipments for the last quarter amounted to 947,357 units which not only represented 27 per cent of the total volume for 1936 but was 14 per cent above the best previous last quarter and 93 per cent above the five-year average for the period.

Total shipments for the year exceeded those for 1935 by 23 per cent. In only two years—1928 and 1929—have members of the association shipped more vehicles than they did last year.

The report which includes the operations of all but one of the major motor vehicle manufacturers in the United States is summarized below:

December, 1936	389,382
November, 1936	340,635
December, 1935	321,266
Last quarter, 1936	947,357
" " 1935	828,266
12 months, 1936	3,512,436
12 months, 1935	2,859,163

11 Months' Exports $211,436,023

Exports and Imports of the Automotive Industry for November and Eleven Months Ended November, 1936-1935

	NOVEMBER 1936		NOVEMBER 1935		ELEVEN MONTHS ENDED NOVEMBER 1936		ELEVEN MONTHS ENDED NOVEMBER 1935	
	No.	Value	No.	Value	No.	Value	No.	Value
EXPORTS								
		$		$		$		$
Motor vehicles, parts and accessories	.....	21,218,061	.....	21,884,674	.....	211,436,023	.....	207,567 294
PASSENGER CARS								
Passenger cars and chassis	19,918	11,739,576	22,491	11,185,722	155,310	88,635,242	155,944	85,595,844
Low price range $850 inclusive	18,427	10,144,598	21,476	10,024,520	142,872	74,613,123	144,988	73,755,262
Medium price range over $850 to $1,200	1,269	1,188,681	613	598,337	10,106	9,675,310	7,918	7,522,009
$1,200 to $2,000	145	222,510	200	289,777	1,542	2,304,962	1,255	1,913,021
Over $2,000	77	183,787	91	226,285	790	2,041,847	758	1,980,837
COMMERCIAL VEHICLES								
Motor trucks, buses and chassis (total)	7,374	3,651,063	8,038	3,881,597	95,386	49,036,933	88,804	45,918,262
Under one ton	884	324,411	1,495	454,359	14,309	5,465,946	8,976	3,023,858
One and up to 1½ tons	5,532	2,365,310	5,267	2,416,684	64,149	29,513,237	63,791	29,315,227
Over 1½ tons to 2½ tons	757	589,808	1,018	746,808	12,474	9,249,040	13,286	9,777,668
Over 2½ tons	197	380,316	217	236,041	2,572	3,887,607	2,250	3,386,519
Bus chassis	4	11,218	19	19,326	1,882	921,103	249	298,006
PARTS, ETC.								
Parts except engines and tires	.....	.....	.....	.....	.....	.....	.....	.....
Automobile unit assemblies	.....	2,674,890	.....	3,253,931	.....	36,464,087	.....	41,919,479
Automobile parts for replacement (n.e.s.)	.....	2,138,658	.....	2,345,828	.....	24,328,700	.....	24,198,645
Automobile accessories (n.e.s.)	.....	308,788	.....	294,870	.....	3,066,172	.....	2,874,133
Automobile service appliances	.....	413,707	.....	270,599	.....	4,202,042	.....	3,749,861
Airplanes, seaplanes and other aircraft	32	525,224	26	315,151	435	9,310,837	322	6,163,769
Parts of airplanes, except engines and tires	.....	553,749	.....	570,051	.....	5,643,262	.....	4,790,823
INTERNAL COMBUSTION ENGINES Stationary and Portable								
Diesel and semi-Diesel	36	58,758	41	73,256	358	970,915	301	803,098
Other stationary and portable:								
Not over 10 hp.	1,323	77,962	688	49,767	12,308	711,160	8,878	524,026
Over 10 hp.	128	78,982	70	40,946	2,075	938,686	1,311	745,553
Automobile engines for:								
Motor trucks and buses	1,817	175,099	2,367	220,048	20,228	1,979,658	6,816	790,725
Passenger cars	2,374	129,781	3,976	344,589	40,778	2,791,859	26,002	1,765,825
Engines and aircraft	58	207,773	90	448,002	785	4,336,217	5o4	2,392,314
Accessories and parts (carburetors)	.....	152,894	.....	134,832	.....	1,778,763	.....	1,473,706
IMPORTS								
Automobile and chassis (dutiable)	106	74,706	85	35,295	981	500,914	550	266,398

:SLANTS:

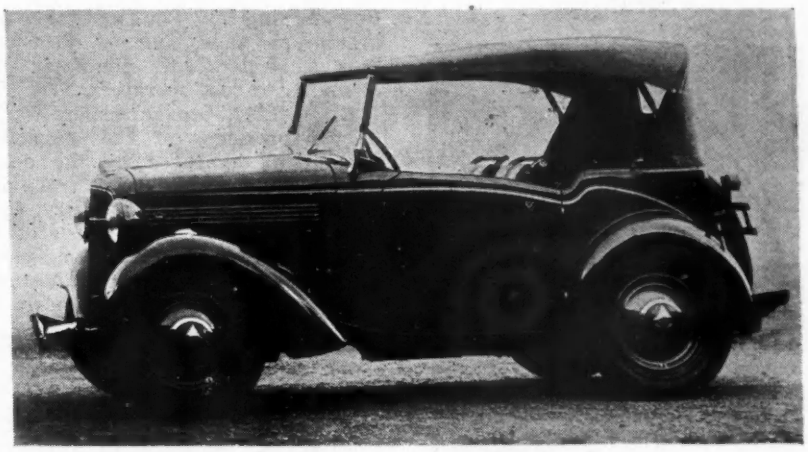
COSTLY ANTIQUE—*Fifteen thousand dollars is probably a record price to pay for a 12-year-old automobile. But Prince Chula of Siam, a resident of London, has just paid that much cash for the Delage racer of 91½ cu. in. displacement designed in 1923 and raced for the first time in 1924. During the past season the car was driven by Richard Seaman and won practically every event in which it was entered. Engineer Lory was responsible for the design of the car. While it has been kept in good condition it has not been modified in any way since it was built.*

Delage is reported to have recently refused an offer of $35,000 to build a duplicate.

TRAVELOG—*As a means of promoting American tourist travel in Mexico, General Motors of Mexico will make a series of six motion pictures showing highways and places of interest in Mexico City and vicinity. The films are to be exhibited in 25,000 U. S. motion picture theaters. A well-known Hollywood firm is doing the filming with the cooperation of the Mexican government's tourist department. First of the films will show the international highway from Laredo, Texas, to Mexico City.*

FORECASTS—*Strikingly accurate were some of the predictions made in the presidential poll conducted by Studebaker. While nation-wide straw-votes gave results far wide of the actual vote, the five winners of Studebaker President sedans came within a fraction of one per cent. The winner, Houston W. Glasgow, a Los Angeles WPA worker, said that Roosevelt would win with 27,752,420 votes, an error of only 111.*

FAITHFUL—*Scattered through the Graham plant in Detroit there are 41 "old timers" who boast of 20 or more years with the company or its predecessors. Some have been there from the days of three-cylinder, two-cycle engines to the present time with its streamlining and supercharged power-plants. One of the most faithful is George Peterson, now factory manager, who has a record of 28 years of uninterrupted employment.*



New Ohta sport phaeton being built by the Kosoku Kikan Co. of Japan.

HOMES ON WHEELS—*Between 40,000 and 50,000 trailer coaches are now being used as permanent homes, said George Terbough, of the Federal Reserve Bank board, speaking before the American Economic Association in Chicago last week, adding that they are helping to solve the nation's housing problem. Total number of trailers used as full or part time residences is about 300,000, Mr. Terbough estimates.*

OUTSTANDING—*Paul G. Hoffman, president of Studebaker, is listed among the 12 outstanding young men of the country for 1936 by Duward Howes, Los Angeles editor of "America's Young Men." The distinction goes to Mr. Hoffman because of his "outstanding contribution to the cause of traffic safety."*

Boat Show Scores Great Success

Crowds Jam Grand Central Palace Where Several Hundred Craft and Numerous Engines Are Displayed

More than 15,000 persons converged on Grand Central Palace, New York, Jan. 8 to get an eyeful of boats and marine equipment exhibited at the thirty-second annual National Motor Boat Show staged by the National Association of Engine and Boat Manufacturers. So great was the press of attendance of pleasure boat enthusiasts eager to examine the offerings for the 1937 yachting season, the show manager, Ira Hand, secretary of the National Association, ordered the front doors of the palace closed for a half-hour. The situation eased somewhat as people drifted over the three floors devoted to exhibits of boats, engines and marine accessories.

At least 100 craft, ranging upwards to cruising yachts over 50 ft. in length were crowded into the main floor area. Marine engines were located on the mezzanine floor, where small boats were also displayed. The third floor of the palace was devoted to the display of marine accessories. In all, there were more than 155 individual exhibits.

Many new marine engines, in addition to those described in the Jan. 9 issue of AUTOMOTIVE INDUSTRIES, were exhibited at the Motor Boat Show.

The Caterpillar Tractor Co., Peoria, Ill., participating in the show for the first time, introduced two Diesel marine engines. The smaller of these, a 4-cyl. engine, develops 44 maximum b.hp. at 1400 r.p.m. The larger unit, a V-type 8-cyl. Diesel, has a horsepower rating of 160 which is developed at 850 r.p.m.

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Hupp Special Meeting Adjourned to Jan. 28

The annual meeting of the Hupp Motor Car Corp. was held at Richmond, Va., Jan. 7, but the special stockholders' meeting called for the same date to consider recapitalization plans was adjourned due to lack of a quorum to Jan. 28, 1937.

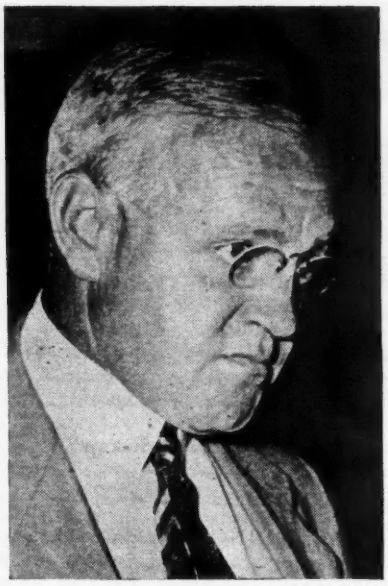
Hal H. Smith of Detroit, and A. A. Anderson of Grand Rapids, were re-elected directors at the annual meeting. Archie M. Andrews, whose term as a member of the board expired, was not reelected.

Trailer Maker Resumes Production

The Prairie Schooner Trailer Co., Elkhart, Ind., whose plant was destroyed by fire Dec. 31, has started production in another location in that city.

Leaders of the motor boat industry: (left to right) Charles A. Criqui, pres. Sterling Engine Co. and vice-pres. of the National Association of Engine and Boat Mfrs.; George W. Codrington, pres. Winton Engine Co. and vice-pres. of the association; Ira Hand, manager of the National Motor Boat Show and for 26 years secretary of the association; and Henry R. Sutphen, pres. of the association.

Strategist



Acme photo

Donaldson Brown, vice-president, and chairman of the finance committee of General Motors, has had an active part in planning the corporation's defense

Fleet Sales to Dealers

Patman Explains Bill Which Would Halt Direct Selling by Factories

Fleet sales of motor vehicles by manufacturers to the consumer would be eliminated if the Wright-Patman bill, to be introduced at this session of Congress, becomes a law. Mr. Patman, sponsor of the Robinson-Patman Act, left no doubt on this point in the minds of members of the National Automobile Dealers Association whom he addressed this week at their annual meeting in Detroit.

Contending that such sales, both to the Government and to industry, should be made through regular dealer channels, Mr. Patman intimated that factory branches, parts discounts and factory financial interest in dealerships might also be targets of the new legislation he plans. In Mr. Patman's view the Patman-Robinson Act of 1936 has more ways of effective enforcement than any law upon the statute books of the United States.

Reiterating his belief that this law will not be changed at this session of Congress, Mr. Patman said: "We do not need an amendment to strengthen it and we believe we can defeat successfully an amendment which proposes to weaken the law."

An address by Congressman John D. Dingell, Detroit, was followed by a NADA resolution asking Congress to repeal the Federal excise tax on automobiles.

After the strong speech by Patman before the NADA, rumors were rife this morning that Ford and other manufacturers have dumped fleet sales back to dealers and eliminated parts discounts to fleet operators.

E. M. Lied, Omaha dealer, was reelected president of the association. Resolutions approved by the dealers were directed against unfair trade practices in the automobile industry, favoring work through state legislatures to attain fair trade practice legislation, and authorized a cooperative interest in highway safety effort, particularly uniform legislation in states.

The president of the association was empowered to appoint a legislative committee of five to promote national and state legislation favorable to automobile dealers. A budget of $15,000 for the committee was also approved.

Murphy Acts as Mediator

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settled on a national basis. These were: the 30-hour week, exclusive bargaining agency, American standard of living issue, and the matter of a general conference.

"We are accused of having a minimum wage below the American standard of living. That is something for us to look into. We certainly don't want to be below the American standard." Such a subject as the speed of the conveyor line was a matter for plant managers to settle. He said there were no points on which General Motors would not negotiate. "That would not be collective bargaining." He said the corporation had been carrying on collective bargaining since 1934 when the procedure was set up.

"A big corporation gets more or less blame for being big but it is big only because it gives service. If it doesn't give service, it gets smaller faster than it gets big. GM has tried to do the right thing. We have kept wages up, given bonuses, tried to do the progressive thing," Mr. Knudsen declared.

He declined to comment on a referendum among GM employes until a definite proposal was made.

W. S. Knudsen and union leaders accepted Governor Murphy's invitation to a conference in Lansing Thursday. Participating in the conference were Knudsen, Donaldson Brown and John Thomas Smith for GM and Homer Martin, Wyndham Mortimer and H. John Brophy for UAW. John F. Dewey, J. E. O'Conner and E. C. McDonald also attended.

In his letter of acceptance to the governor, Knudsen said: "We are keenly alive to the high concept you hold in regard to your duties in behalf of the citizens of Michigan and anxious to extend whatever assistance we can toward accomplishment of your objectives without sacrifice of principles which we hold to be of vital consequence to our industry and the state."

Martin in his acceptance wired the governor stating: "The UAW has been ready at all times, through conference and collective bargaining, to arrive at a settlement which would be fair to all parties concerned, including the public."

Over 9000 employes of Chevrolet gear and axle division of GM, nearly the entire force, staged a demonstration against the strike Wednesday. Mass meetings were held in the plant's four cafeterias and committees were appointed to express opposition to the UAW. Proposals were made for a mass movement on Flint but more peaceful measures prevailed and a committee was appointed to express opposition in messages to the governor and President, also to arrange for a protest meeting for all GM employes at the state fair coliseum. Demonstrators carried banners with such legends as: "We don't want a strike"; "We want our jobs back"; "We object to minority rule"; and "No labor dictator for us."

GM employes in Saginaw held a protest meeting Wednesday in the municipal auditorium and were addressed by the mayor and civic leaders. A statement signed by 98.4 per cent of Chevrolet employes at Bloomfield, N. J., expressed their satisfaction with "working conditions and relationships existing between the management and ourselves."

Ternstedt employes, members of Post No. 166 of the American Legion, passed a resolution objecting to methods of strikers and urging union men to return to work.

Evidence of opposition to the strike accumulates as additional protests are wired to the President and GM employes unite to protest enforced idleness. According to T. J. Forsythe, chairman of the Ternstedt Employes Association, approximately 9000 of the company's 12,000 workers signed cards repudiating the UAW and asking that they be permitted to return to their jobs. Appeal has also been made to the President, the Governor and Secretary Perkins.

The bargaining committee of the Chevrolet parts plant in Bay City wired the President urging him to do all in his power "to end this strike which has forced out of work 2300 fellow workers who, through their own petitions, have expressed their satisfaction with working conditions in this plant."

Employes of Pontiac Motor Car Co. appeal to Governor Murphy "to ask our President, Hon. Franklin Delano Roosevelt, to tell labor to return to work until necessary legislation can be passed satisfactory to labor and industry."

An incipient strike at the Pontiac plant was promptly quelled Monday by the workers themselves. Five men who had been told to remove union buttons attempted to start a sitdown strike but were quickly ushered to the plant gates by other workers. Seven other men are said to have walked out in sympathy with the strikers. The plant employs 9300 workers.

Twenty men at the Yellow Coach &

Truck Co., division of GM, attempted a sitdown strike in one department Monday. After the department superintendent talked with the men, four strikers left the plant, five returned to work immediately and the others resumed work in a short time, the company reported.

Declaring that "protection of the citizen is the first duty of the city government," a committee of 11 Pontiac employes applied to the city manager, W. P. Edmonson, for protection for employes who wished to continue working. The request was granted.

The Fisher Body plant at Pontiac with 7300 workers and the Fisher plant at Lansing with 4100 closed Tuesday night due to material shortage.

The Pontiac final assembly line was forced to close Wednesday because of body shortage, laying off 1800 men. Approximately 7500 will continue for a time manufacturing parts for stock.

Oldsmobile closed its final assembly line Wednesday due to body shortage, laying off 5000 of its 7900 employes.

Rioting broke out at Fisher Body plant No. 2 at Flint Monday night, resulting in injuries to 21 men, including seven policemen and one deputy sheriff. Governor Murphy arrived in Flint early Tuesday and ordered a detachment of state police and a company of Michigan National Guards was mobilized to maintain order.

Rioting is said to have broken out as a result of an attempt by company police to prevent delivery of food to stay-in strikers. Heat in the plant is reported to have been shut off at noon on Monday, and the main gate to the plant locked. A pitched battle raged for 20 minutes between 30 to 40 policemen and several hundred strikers, while several thousand spectators looked on. Tear gas had little effect because of the wind.

Warrants for the arrest of seven alleged strike leaders and 10 others said to have engaged in the Flint riot Monday night were issued Wednesday afternoon at request of Joseph R. Joseph, Genessee County prosecuting attorney.

Ten other warrants issued against men injured in the riot were served in the Genessee County jail where the men were transferred from the hospital. Nine hundred more guardsmen from Detroit moved into Flint, bringing the total troops stationed there to 2300. A city-wide mass meeting for automobile workers was called by the UAW for 2 p. m. Sunday in Detroit.

The Fleetwood plant in Detroit, making Cadillac bodies, closed Tuesday morning as a result of a sitdown strike started by 69 union workers and 1800 employes were thrown out of work.

Briggs Plant Picketed

Strikers are picketing the Meldrum Ave. plant of Briggs Mfg Co. which makes bodies for the Lincoln and Lincoln-Zephyr divisions of Ford Motor Co. A small group of sitdown strikers were ejected from the plant last week and the company claims to be operating, although the union maintains production has been halted. Although at first unauthorized by the UAW, the strike is now being supported by the union, according to Emil Mazy, organizer, who says: "It is unfortunate the boys were called on to strike because we hoped to keep all plants supplying Ford and Chrysler operating while the GM strike is going on."

Flint Blames Outsiders

(The following impartial account of the labor disturbances in Flint, Mich., was written for AUTOMOTIVE INDUSTRIES *by a long-time resident of that city.)*

Correspondents sent here to cover the auto strike situation climaxed by Monday night's skirmish between police and strikers at Fisher plant No. 2, are amazed to find this an anti-strike community. They have been in other General Motors plants and have seen thousands of workers remaining on the job as long as materials hold out. They find, even though the UAW drive is concentrated here, the union has been unable to interfere with production in these plants. They have had the opportunity to see the signatures of 26,887 employes in the Buick, Chevrolet and AC plants attached to declarations of loyalty and the desire to work.

Many of the correspondents attended a hurriedly summoned mass meeting of professional and business men who unanimously adopted resolutions against the strike. There has been organized the Flint Alliance for the "security of our jobs, our homes and our community"; downtown headquarters were established and citizens crowded in to sign membership cards. The total already is more than 12,000. Plant bargaining agencies chosen nearly two years ago in an election under Federal auspices through the National Automobile Labor Board have issued formal statements declaring they have enjoyed satisfactory relations with the managements in the adjustment of appeals from employes.

Thousands of telegrams have gone to President Roosevelt, Governor Murphy, members of Congress, Secretary Perkins and others, protesting against the strike. It is estimated that less than 5 per cent of the 42,000 employes of General Motors here have enrolled in the UAW and that only a few hundred of these are responsible for the Fisher strike. The drive has been conducted entirely by outside organizers and supporters from Toledo, Akron and other cities have been brought in for the demonstrations. At the Sunday afternoon strike rally, with weather conditions ideal and the strike presumably at high pitch, and with President Martin and other high officials as attractions, only 600 were present including the out-of-town delegations. This is the situation today in "strike torn" Flint.

GM Welcomes Investigation

The announcement of John L. Lewis, chairman of the Committee for Industrial Organization, that he would ask Congress to investigate the General Motors Corp., made at a press conference in Washington Tuesday was met Wednesday with a declaration by a Washington spokesman for the General Motors Corp., that it would welcome the investigation at any time.

"We have steadily sought to conduct our business so that the more that is known about it the higher will be the regard in which it is publicly held," the GM spokesman said.

"We therefore welcome any competent investigation at any time."

Meanwhile the automobile strike situation was the subject of different conferences in Washington, two of them at the White House. This is the first time that it was publicly announced that the President has taken up the

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International News photo

Edward C. McDonald (left) and John E. O'Connor, Federal labor conciliators try to arrange a meeting between GM executives and strike officials

Business in Brief

Written by the Guaranty Trust Co., New York, exclusively for AUTOMOTIVE INDUSTRIES

There was a moderate decline in general business activity last week. The weekly business index compiled by the *Journal of Commerce* for last week stood at 92.2, as compared with 92.3 the week before and 75.9 for the corresponding period last year. Retail sales at the beginning of this year were from 10 to 15 per cent above those a year ago, while wholesale business showed gains from 18 to 22 per cent.

Chain Store Sales Up 17%

Sales of the first 15 store chains and mail order houses reporting for December were 17.23 per cent above those in the corresponding period last year.

Lumber Orders Heavy

Production of lumber during the week ended Dec. 26 was 40 per cent of the 1929 weekly average. New orders during December were heavy, and bookings during the first three weeks of the month were larger than in any similar period during the year. Production and shipments, however, have shown a seasonal decline recently.

Employment Continues to Rise

According to the Bureau of Labor Statistics, employment in manufacturing and non-manufacturing industries during November continued to gain. Successive increases have been reported every month this year since February. Weekly payrolls during November were about $5,000,000 greater than in the preceding month.

Carloading Hold Gains

Railway freight loadings during the week ended Jan. 2 totaled 587,593 cars, which marks an increase of 25,735 cars above those in the preceding week, a rise of 46,127 cars above those a year ago, and a gain of 90,679 cars above those two years ago.

Farm Prices Rise

The index of prices received by farmers on Dec. 15 stood at 126, which marks a gain of 6 points during the 30-day period ended that date and one of 16 points as compared with the figure a year earlier. Many farm commodities rose in price during the month, with the advances in grains and tobacco particularly sharp.

Fisher's Index

Professor Fisher's index of wholesale commodity prices for the week ended Jan. 9 stood at 90.1, as compared with 88.8 the week before and 87.9 two weeks before.

Federal Reserve Statement

The consolidated statement of the Federal Reserve banks for the week ended Jan. 6 showed a decline of $2,000,000 in holdings of discounted bills. Holdings of bills bought in the open market and of government securities remained unchanged. Money in circulation declined $77,000,000, and the monetary gold stock increased $20,000,000.

Japs Study Fuel Blends

Best Results Shown with 20% Pure Alcohol in Gasoline

Extensive tests of alcohol and alcohol-gasoline blends as a substitute fuel for automobiles which can be produced domestically are being made in Japan. It is also reported that the government is planning to enact a law which will make obligatory the mixing of a minimum percentage of alcohol with gasoline, as is the case in several European countries, in order to reduce importations of petroleum.

The Mining Bureau of the Commerce and Industry Ministry is preparing a number of bills on the subject which will be introduced in the next session of the Diet.

Various methods for the manufacture of alcohol are being studied, the raw materials used being molasses, potatoes and other agricultural products. It is understood that negotiations are under way for the acquisition of a German process for distilling alcohol from sawdust.

The Aeronautical Research Institute of Japan recently published the results of extensive experiments it has made with alcohol blends. According to Major Nishiteru, who was in charge of the tests, pure alcohol did not prove to be a statisfactory fuel, due to excessive consumption and difficult engine starting. Blends of from 10 to 20 per cent alcohol with gasoline were satisfactory in all respects, the report states, provided the alcohol used was 99 per cent pure or better. The experiments showed that the higher the alcohol admixture the greater the power obtainable, and the greater the fuel consumption. Increasing compression ratios added to the economy. Consumption of the blends was slightly higher than that of pure gasoline, but in all cases less than 10 per cent. There was no added difficulty in starting. Major Nishiteru concluded his report by recommending a blend of 20 per cent alcohol and 80 per cent gasoline.

Gasoline Consumption 8.82% Higher in Oct. than Year Ago

Gasoline consumption in October, 1936, amounted to a total of 1,790,901,000 gal. according to the figures of the American Petroleum Association based on the Bureau of Mines' monthly statistics. This was in comparison with 1,645,796,000 gal. in October, 1935. Consumption during the first 10 months of 1936 was 16,304,443,000 gal. compared with 14,837,442,000 during the same period of 1935. Percentage change in the daily average during October compared with a year ago was 8.82 per cent, and for the 10 months' period, 9.53 per cent.

1600 Willys Dealers Already Signed Up

Current distributor organizations for the new Willys car in the domestic sales area total 105 and domestic dealerships are in excess of 1600, according to a statement by F. H. Fenn, assistant to the president of Willys-Overland Motors, Inc.

In the export field, the new Willys is represented in 61 foreign countries, including Europe, Africa, South America, Central America and the Orient. This entire wholesale and retail sales organization has been built up in eight and one-half weeks.

Bendix New York Office Moved

The New York zone office of the Bendix Products Corp., formerly located at 230 Park Avenue, has been moved to 420 Lexington Avenue, it has been announced. Rapid expansion of activities in this territory during recent months made necessary this move to larger quarters.

40 Years Ago

with the ancestors of AUTOMOTIVE INDUSTRIES

Dear Sir:—Your recent editorial on the matter of a signal for horseless vehicles was read with much pleasure, and in reply the writer offers the suggestion that the exhaust gases of the petroleum-driven vehicle can and should be used to actuate an alarm.

In most vehicles of this class the exhaust is very abrupt, and unless muffled makes a very objectionable sound. It would probably suffice as a warning to permit these gases to escape suddenly into the open air without passing through a muffler.

Some have met this suggestion with the argument that it would frighten horses, but there is no reason to suppose this would be any more true of the exhaust noise than of the squawk of a horn or the blast of a whistle. . . .

The writer thinks, therefore, that a very satisfactory solution of your question is found in either using the exhaust noise as a warning, which would be prominently distinctive, or else using the said gases to operate a whistle, which, by its intermittent action, would soon become almost equally distinctive.

Chas. E. Duryea.

—From a letter to *The Horseless Age*, January, 1937.

The Once Over

By H. I. PHILLIPS

CLINICAL NOTE FROM DETROIT

THAT apprehensive expression you see on motorists' faces these early days of the new year is due to the news that Hank Ford has patented a car with the rear end where the front used to be, or vice versa.

* * *

Henry's patent takes the engine from under the hood and places it far astern. Lizzie has had her operations, but putting her lungs and heart under her bustle is the biggest surgical project of her career.

* * *

It will seem mighty strange to pull into a pumping station and watch the attendant go around to the back end of the bus to see if you need any water or oil. Or have the service station man crawl under the rear wheels to see if your fan belt is squeaking again.

* * *

AND imagine not knowing that the radiator is boiling over until some fellow a block behind you yells that you are steaming up his windshield!

* * *

Henry says he is just protecting a patent, but the motor world has been agog ever since the recent announcement. When Ford starts juggling with the vital organs of the automobile it comes under the head of first class clinical news. All the other auto makers leap into their white coats at once as a matter of preparedness.

* * *

Making every motor car in the country old-fashioned with one vivisection would be about the biggest boost the industry could get.

* * *

Henry's patent puts the motor lengthwise beside the right rear wheel. One of the main arguments for it is that it shoves the driver farther up front and gives him a better view of his victims. The slogan of the speed maniacs may soon become, "Don't honk until you see the whites of their eyes!"

* * *

WHEN the new car hits a pole the motor is so far away that it is practically absent from the scene of the crash.

* * *

If the driver hears any funny motor sounds he can always assume they are from a car behind him.

* * *

And one of the great arguments in favor of the rear-end engine will be that (with respectful apologies to the wife) it concentrates all the annoying noises in the rear.

* * *

We trust that the new model doesn't call for putting the suitcases under the hood. There would be nothing more embarrassing in a forgetful moment than to grease the handbags, grind the satchels and fill the suitcase with water.

* * *

Okay, Henry! But while you're at it why not do something for which there is a real demand? Put the horn under the seat!

* * *

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—From the Jan. 7, 1937, daily "column" by H. I. Phillips, reprinted by special arrangement with the copyright owners, Associated Newspapers, Inc., New York.

College Variety Show on Pontiac's Radio Program

Friday, Jan. 22, marks the date for the beginning of a new coast-to-coast NBC red network, half-hour variety radio show that will come each week thereafter direct from the campus of one of the country's colleges or universities under the sponsorship of the Pontiac division of General Motors Sales Corp. It will be billed under the name of the "Pontiac Varsity Show."

Hill Auditorium on the University of Michigan campus in Ann Arbor will be the scene of the opening program. John Held, Jr., artist and cartoonist, and long a favorite among college men everywhere, will handle all programs as master of ceremonies. For the four weeks following the University of Michigan broadcast the Pontiac Varsity Show will bring to listeners its undergraduate variety entertainment from Chicago University on Jan. 29; Ohio State in Columbus, Feb. 5; Columbia in New York City, Feb. 12, and University of Pennsylvania, Feb. 19.

Strikers Occupy Peugeot Diesel Plant at Lille

One of the Peugeot factories has been directly affected by labor disturbances at Lille. The Compagnie Lilloise des Motors, which is Peugeot's heavy oil branch, building Diesels under Junkers license, has been on strike for several weeks, with the strikers in possession of the buildings.

At the head of a number of members of his staff, works manager Pilleverdier endeavored to force a way into the factory, through the porter's lodge, but was met with a volley of projectiles from the strikers and was severely injured. Later the strikers consented to evacute the buildings, but only to establish strong strike cordons outside. The owners have refused to negotiate until they are assured possession of their factories.

J. F. Max Patitz

J. F. Max Patitz, chief consulting engineer of the Allis-Chalmers Mfg. Co., Milwaukee, died suddenly of a heart attack Jan. 3. He had been associated with the company for more than 51 years, during nearly 26 of which he served as consulting engineer.

Mr. Patitz was born in Saxony in 1866. After being educated in the Gymnasium of Dresden, he emigrated with his parents to this country. After working in Pittsburgh he went to Milwaukee and entered the employ of the E. P. Allis Co. in 1885. He was soon promoted and in 1901, when the company became the Allis-Chalmers Co., he was placed in charge of the building of steam engines and compressors.

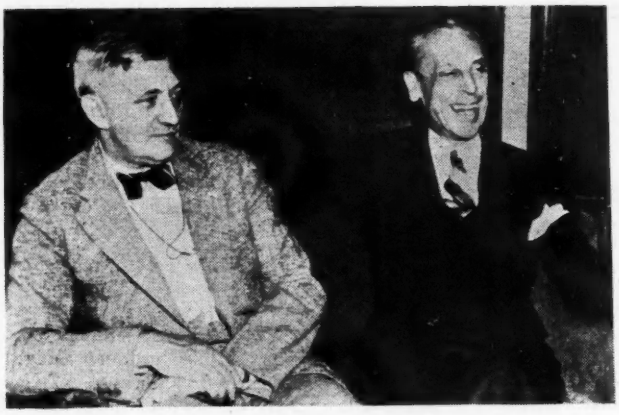
Numerous trips abroad were made by Mr. Patitz to investigate European engineering developments in his field and he was intimately connected with the development of Allis-Chalmers tractors and farm machinery. Mr. Patitz was considered an authority on intricate mathematical calculations connected with the design of machinery and his studies of critical speeds and of vibrations in high speed machines were outstanding. He was a member of the Society of Automotive Engineers and of the American Society of Mechanical Engineers.

W. Paul Eddy to Prepare Exchange Paper for AFA

The American Foundrymen's Association exchange paper for the 1937 meeting of the French Foundry Technical Association is to be prepared by W. Paul Eddy, Jr., chief metallurgist of the General Motors Truck Corp., Pontiac, Mich. Mr. Eddy is the author of many technical papers, a member of the American Society for Metals, American Society for Testing Materials and the British Institute of Metals.

December New Car Sales Estimated at 290,000

New passenger car sales in the United States last month are estimated at 290,000, well above the 237,194 recorded in December, 1935, R. L. Polk & Co. announced this week. This also exceeds the November, 1936, sales total by approximately 30 per cent. Estimates were based on returns from 110 large cities, covering the first 25 days of the month.



Unworried

William S. Knudsen and Alfred P. Sloan, Jr., seem sure of the ultimate victory of General Motors against strikers.

International News photo

GM Welcomes Investigation

(*Continued from page 73*)

situation, though White House intervention still seems to be improbable in the near future. It is clear that the Administration is anxious to avoid active participation in labor troubles of any kind but is directing efforts toward conciliation through Department of Labor representatives.

The automobile strike situation shared with the maritime strike in discussions the President held Wednesday with Assistant Secretary of Labor Edward F. McGrady and Secretary of Labor Frances Perkins at separate conferences. Following his conference with the President, McGrady, disclosing the Administration's apprehension, said that the automobile strike situation is "jittery." Miss Perkins announced that unless the strike is settled by the end of the week she will go to Detroit.

Lewis' statement that he would ask Congress to investigate General Motors to determine whether "foreign influences should dictate the labor policy in America" came on the heels of a "strategy" conference in Washington he held with President Homer Martin of the UAW and Sidney Hillman, president of the Amalgamated Clothing Workers, a CIO affiliate. Mr. McGrady, labor trouble-shooter for the Administration, was present during a part of the session to get a first-hand report on the automobile strike situation, and it is assumed he informed the President of the information he gathered.

Cleveland Situation Static

No factories to date except the Fisher Body plant itself have been closed in Cleveland due to the strike of automobile workers. Unofficial figures give 1500 laid off in the Republic Steel system. Most of these are in Youngstown and Monroe, Mich., with a smaller number in Cleveland. Otis Steel is expecting lay-offs due to cancellations later this month. Seventy-five have been laid off at National Acme Co. due to cancellations from Chevrolet for screw machine products.

Ouster of Committee for Industrial Organization unions from the AFL was presaged in Cleveland Wednesday when the Metal Trades Council and the Building Trades Council took steps to turn the truce between the two groups into open warfare. They denounced the automobile workers for assuming jurisdiction in calling out their members at Fisher Body and approved a letter asking Lincoln Scafe to reopen the plant. The employes' committee at the same time announced it has letters from 4156 of the 7200 Fisher Body employes now out, asking that the plant be reopened. When 5000 have been received a direct appeal to President Roosevelt will be made.

Tire Makers Still Unaffected

While the three major Akron tire firms—Goodyear, Goodrich and Firestone—which supply 60 per cent of all original equipment tires, have as yet made no cuts in production schedules due to the automotive strikes, all three are operating on a day-to-day basis with schedules subject to a 24-hour change and curtailment. Unless the automotive strike ends quickly it is practically a foregone conclusion that these three companies will be forced to curtail production drastically within another week. Goodrich is affected more seriously than either Firestone or Goodyear, for the time being, supplying a substantial portion of Chevrolet tires.

Michigan Tool Strike Ends

The week-old strike at the Michigan Tool Co. in Detroit, called by the MESA, was settled Monday night by the company's agreement to reinstate 25 union members who had been laid off, according to MESA Secretary Matthew Smith. The matter of wages is being negotiated.

Mediator Works on Glass Strike

Hope for settlement of the flat glass strike appeared a bit more distant when Ralph Lind, Federal mediator, announced postponement of a joint meeting of Libbey-Owens-Ford and union officials originally scheduled for Wednesday. He has received written statements from both the company and the union as to what their "irrevocable offers" for settlement are and will study and analyze the proposals before discussing them separately with each group. He will call the two together later when it appears a basis for agreement is available. It is understood that the union has abandoned several demands, including the closed shop and check-off of union dues.

United Brass Employes Strike

A sitdown strike at the plant of the United Brass & Aluminum Co., Port Huron, was started Wednesday with strikers demanding a wage increase, minimum rates and reduction in hours. The company employs 300 workers and makes brass, aluminum and iron castings for automobile companies.

New Goodyear Plant at Jackson

Work of razing several old buildings of the Kelsey Hayes wheel factory at Jackson, Mich., to clear the site for construction of the new Michigan factory of the Goodyear Tire and Rubber Co., is progressing rapidly. The old structures will be replaced by modern buildings, and many of the more modern units of the former Kelsey Hayes plant will be completely remodeled and retained by Goodyear.

William H. Kilpatrick

William H. Kilpatrick, vice-president and general manager of the Chrysler Motor Parts Corp., and a close friend and associate of Walter P. Chrysler since their youth, died in San Francisco Jan. 12.

R. E. OLDS has resigned as chairman of the board of directors of the Reo Motor Car Co. A pioneer of the automobile industry more than 40 years ago, Mr. Olds now wishes to be "free to enjoy vacations unhampered by responsibility." He plans an extended trip to Ca'ifornia and Australia.

O. T. KREUSSER has been appointed general manager of the Allison Engineering Co., division of General Motors, at Indianapolis, Ind.

H. C. MERRITT, general manager of the tractor division, Allis-Chalmers Mfg. Co., Milwaukee, has been elected a vice-president of the corporation. He was placed in charge of the division in 1926 and has developed it into one of the most important units of the extensive Allis-Chalmers industry. Among Mr. Merritt's notable achievements was to introduce pneumatic-tired farm tractors.

F. E. MOSKOVICS, member of the board of directors of the American Standards Association, has been made chairman of the executive committee of the Dictograph Products Co. He has been a member of the ASA board since 1929 and served as vice-president from 1932 to 1936.

Just Among Ourselves

Detroit, Mich.

TWO powerful voices in the automotive industry, the Society of Automotive Engineers and the National Automobile Dealers Association, converged their membership on Detroit this week for annual meetings of unusual interest. In both instances, in spite of—or perhaps because of — strikes and rumors of strikes, attendance was large, and the meetings seemed of unusual significance.

In the case of the SAE, increased interest was apparent in the social responsibility of the engineer as expressible through highway safety efforts and in designing motor vehicles with more direct concern for the operator's comfort and welfare.

An aggressive NADA meeting, attended by quite a few factory executives, heard Representatives Patman and Dingell express unusually frank opinions on the prospects of State and National legislation affecting motor vehicle merchandising and went into a huddle on ways and means of promoting legislation favorable to the dealer.

Everything considered — including labor difficulties—we believe the week beginning Jan. 10 may stand out in the immediate future as a period of historical interest to the motor vehicle industry, for every branch of the industry.

Strike Situation Is First in the Minds

LABOR difficulties are, of course, the inescapable subject for conversation in Detroit. After a week largely devoted to pulling front and back doorbells in search of Mr. Alfred E. Smith's real Mr. McCoy we find:

1. No overwhelming reason to change our mind on last week's editorial points as expressed in this department.

2. More points of view and special "angles" in the motor vehicle labor problem than Mr. Heinz has products.

3. The possibility of one generalization, which is that anything may happen.

The union's high command, as we get it, figures that finances considered, they could hold out on the present or an extended basis for about 60 days. In the minds of some observers this automatically places definitive settlement of the present difficulties on something approaching a ninety-day basis. Other estimates of the duration vary from 30 days to the first of July.

Most of the estimates take the plate glass strike into consideration as a variable and less predictable factor. In the motor vehicle industry, as we pointed out last week, the unions do not control directly any large number of men except in a few plants.

The mass counter-strike movements by Chevrolet and other employes indicate to our mind the truth of this contention, and will go far to hasten the eventual settlement of the motor-vehicle strikes.

In the glass industry, however, craft unionism has been firmly established over a period of a half century or more. The objectives for which the glass unions are working were implanted in the minds of their members, not yesterday but many years ago. They know what they are fighting for, and are recruited largely from a dour race which will fight to the point of starvation in defense of its principles, however mistaken they may be.

National Origins A Settlement Factor

WHICH reminds us that the element of nationalities is not without significance in the difficulties of the motor vehicle industry. In one discussion to which we listened, a speaker advanced the view that if a Voice from Washington were piped over the air into all the plants and areas where strikes are under way it might have a very Soothing Effect. Snapped another party to the conversation, "Yes, if the voice were translated into 37 languages at once."

A factory manager of long experience with labor confirmed our inference from this that certain national groups among the workers, no matter how much apparent solidarity there might be on broad principles, would feel the urge of thrift and loyalty reassert itself, and might, unconsciously, begin to yearn for jobs and stability sooner than other groups.

The most disquieting feature about the whole business is that it can spread to other plants, either while the present strike is in progress, or later to seek equality of attainment with General Motors unions.

We believe now, as last week, that these attainments will be negligible, but there is the possibility that they may furnish a paper basis for additional argument in other plants, unless management should move to anticipate them.

To date the industry as a whole has maintained consistently the principles that difficulties shall be dealt with on an individual basis. No "board of

(Turn to page 80, please)

U. S. New Car Registrations and Estimated Dollar Volume by Retail Price Classes—November

	UNITS					ESTIMATED DOLLAR VOLUME*				
				Per Cent of Total					Per Cent of Total	
	1936	1935	Per Cent Change	1936	1935	1936	1935	Per Cent Change	1936	1935
Chevrolet, Ford and Plymouth	133,514	144,278	− 7.5	59.93	65.67	$85,500,000	$86,000,000	− 0.5	52.55	56.62
Others under $750	38,691	31,767	+ 15.8	16.47	14.46	26,800,000	22,500,000	+ 19.1	16.47	14.81
$751-$1000	38,565	30,677	+ 25.3	17.31	13.96	31,800,000	26,000,000	+ 22.2	19.55	17.12
$1001-$1500	11,973	10,794	+ 10.8	5.37	4.91	13,800,000	12,200,000	+ 13.1	8.48	8.03
$1501-$2000	824	1,016	− 8.9	.37	.46	1,400.000	1,700,000	− 17.6	.86	1.12
$2001-$3000	937	782	+ 19.9	.42	.36	2,300,000	2,000,000	+ 15.0	1.41	1.32
$3001 and over	283	396	− 28.5	.13	.18	1,100,000	1,500,000	− 26.7	.68	.98
Total	222,787	219,710	+ 1.5	100.00	100.00	$162,700,000	$151,900,000	+ 7.2	100.00	100.00
Miscellaneous	773	552	+ 40.0							
Total	223,560	220,262	+ 1.5							

U. S. New Car Registrations and Estimated Dollar Volume by Retail Price Classes—Eleven Months

	UNITS					ESTIMATED DOLLAR VOLUME*				
				Per Cent of Total					Per Cent of Total	
	1936	1935	Per Cent Change	1936	1935	1936	1935	Per Cent Change	1936	1935
Chevrolet Ford and Plymouth	1,987,850	1,715,292	+ 15.9	64.70	68.47	$1,203,700,000	$1,047,800,000	+ 15.0	56.43	60.56
Others under $750	450,322	355,572	+ 27.0	14.66	14.19	324,600,000	253,100,000	+ 28.3	15.22	14.63
$751-$1000	483,003	333,625	+ 45.0	15.72	13.32	402,100,000	282,800,000	+ 42.2	18.85	16.35
$1001-$1500	129,542	81,386	+ 59.4	4.22	3.25	148,500,000	94,900,000	+ 56.8	6.96	5.49
$1501-$2000	9,503	6,507	+ 46.1	.30	.26	16,500,000	10,990,000	+ 50.2	.77	.64
$2001-$3000	7,703	8,552	− 9.9	.25	.34	19,700,000	23,400,000	− 16.8	.92	1.35
$3001 and over	4,651	4,151	+ 12.1	.15	.17	16,000,000	17,100,000	+ 5.2	.85	.98
Total	3,072,574	2,505,085	+ 22.9	100.00	100.00	$2,133,100,000	$1,730,090,000	+ 23.1	100.00	100.00
Miscellaneous	4,688	1,650	+184.0							
Total	3,077,262	2,506,735	+ 23.0							

*All calculations are based on list price f.o.b. factory of the five-passenger, four-door sedan in conjunction with actual new car registrations of each model. The total dollar volume for the different models is then consolidated by price classes.

With Allied Industries

Allis-Chalmers Mfg. Co., Milwaukee, announces that its subsidiary, Condit E'ectrical Mfg. Corp., of Boston, Mass., will be operated as a company unit in the future, and will be known as Allis-Chalmers Mfg. Co., Condit Works. George A. Burnham will be assistant manager of the electrical department in charge of sales and engineering of the switchgear division; W. S. Edsall will be manager of sales, switchgear division; H. V. Nye will be engineer in charge of the switchgear division, with headquarters in Milwaukee; and the works organization will be under the direction of Frank W. Young, manager, and Richard Bechtner, assistant manager.

George W. Swain, formerly Philadelphia district manager of Goodrich, has been named vice-president and general manager of the B. F. Goodrich Rubber Co. of Canada, Ltd., Kitchener, Ont.

The Wheelco Instruments Co. of Chicago has opened a Detroit office located at 6432 Cass Avenue with James A. Harrison, engineer, in charge as district manager.

The Worthington Co., Inc., with offices in Seattle, San Francisco, Los Angeles and El Paso, has been absorbed, effective Jan. 1, by its parent organization, Worthington Pump and Machinery Corp., of Harrison, N. J. The Carbondale Machine Corp., another Worthington subsidiary, was absorbed by the parent company last December.

Election of a new board of directors and executive officers of the Whitney Chain & Manufacturing Co., Hartford, Conn., has been announced. Charles E. Wertman is president; Winthrop H. Whitney, vice-president and treasurer; Carl A. Gray and A. S. Basten, vice-president; Park C. Boyd, secretary and assistant treasurer. The new board of directors includes: Robert T. Stevens, president of J. P. Stevens Co., New York; and Messrs. Wertman, Whitney, Gray and Basten.

Thomas H. Wilber has been appointed general manager of the Bullard-Dunn Process division of the Bullard Co., Bridgeport, Conn. Thomas E. Dunn, Jr., has been appointed to the sales department of the division and will have offices at 309 Miller-Storm Building, Detroit.

Trailer Cushion, Inc., has been formed in Elkhart, Ind., to manufacture studio couches, cushions and curtains for trailer coaches. John Drexler, president, said operations would start about Feb. 1. The company will maintain an engineering service for the design of trailer interior furnishings.

George R. Murray, formerly specialist sales engineer of the Chambersburg Engineering Co., Chambersburg, Pa., has been appointed works manager of the Chambersburg plant with responsibility for all production operations, effective Jan. 1.

Studebaker Exports High

Studebaker Export Corp., registered, in 1936, the largest year's sales since 1928. The year topped the total exports for the three combined years 1931, 1932, 1933 by approximately 10 per cent.

An 8-page booklet on the **oxygen lance** has been made available by the Linde Air Products Co., New York.*

A booklet entitled "Airco Acetylene" has recently been made available by the Air Reduction Sales Co., New York. It contains a crisp presentation of the story of **acetylene** versus various other fuel gases.*

The Link-Belt Co., Chicago, recently completed a 96-page 1936 edition of data book No. 125 on Silverstreak silent **chain drives** of fractional horsepower up to 2000 hp.*

C. J. Tagliabue Mfg. Co., Brooklyn, N. Y., has announced publication of a new **oil testing instrument** catalog, No. 699D.*

"A Buyer's Guide to Diamond **Mechanical Rubber Goods**" is the title of a 27-page illustrated catalog just issued by the Diamond Mechanical Div. of the B. F. Goodrich Co., Akron, Ohio.*

The Landis 16 in. type D **hydraulic crank pin grinder** is described in catalog N-36 recently brought out by the Landis Tool Co., Waynesboro, Pa.*

Obtainable from editorial department, AUTOMOTIVE INDUSTRIES. Address Chestnut and 56th Sts., Philadelphia.

Automotive Metal Markets

Heavy Consumer Stocks as Well as Strikes Responsible for Slowing Up Steel Production Rate

By William Crawford Hirsch

Activity in the steel market is retarded by labor troubles in the automobile industry as well as by the fact that consumers whose operations are unimpaired are generally well covered for their nearby needs. With the uncertainty created by the activities of the Steel Workers Organizing Committee, not a few consumers are prodding mills for deliveries even if this means inconvenience and expense in stocking the steel.

The dip in finishing mill operations is sensed to be considerably sharper than that in the ingot output, which this week is reported to be at 78.8 per cent of capacity, compared with 79.4 per cent in the preceding week, some sheet producers having had to curtail operations radically, to avoid congestion by reason of accumulations of "hold" orders. Strip mills are also operating at a more leisurely pace than they were a few weeks ago. Makers of cold finished steel bars have had to trim their operating rate.

There is talk of rounding out the recent price advances by marking up for the second quarter a number of steel products that do not come within the scope of automotive consumption, such as pipe and nails. No mention,

however, is made of tin plate, the price of which was left unchanged in the recent advance, giving canners and packers a considerable advantage over other steel consumers. Second quarter prices for steels entering into automotive consumption will hardly come in for much consideration before developments during the next two months reveal more clearly whether or not first quarter prices have become solidly entrenched and how volume of demand at the higher levels stacks up.

Pig Iron—What buying there is by automotive foundries, consists more or less of single carloads. The 50 cents per ton advance has become fully established in all markets.

Aluminum—With the price of copper climbing upward, aluminum prices gained in firmness. The possibility that aluminum may find application as an admixture with nickel and chromium in the making of stainless steels, thereby improving their working properties, is an interesting development. Prices are quotably unchanged.

Copper—Producers chalked up 12½ cents as the price of copper on Monday. The new price, denoting an advance of half a cent, lifts the price to the highest level in six years. A corresponding advance in prices of copper and brass products was announced forthwith. The sharp rise in copper prices is attributed by producers to an advance in London which lifted foreign markets to the equivalent of 12⅛ to 12¾ cents, and, which, say the producers, might have led to shipments of copper abroad, had they not put up the domestic price. Advices from London say that American speculative interests are responsible for the rise on the London Metal Exchange. On the New York Commodity Exchange, nearly 4000 tons were traded on Monday, outside speculators putting the price up, with the American consumer expected to foot the bill.

Tin—Considering the capers in the copper market, that in tin was a tame affair in the forepart of the week, spot Straits being held at 51.30 cents, unchanged from last week's close.

Lead—So far no mark-ups in response to higher prices in London have been noted.

Zinc—The price of zinc was advanced $4 a ton as the result of bullish maneuvers in London. The market now is 13 per cent higher than a month ago.

West, Meet East!

Here Are the Men Behind Japan's Bid for a Place as Motor Vehicle Manufacturing Nation

No. 2. Goro Matsukata

Like many of our own automotive pioneers, Goro Matsukata was fired by enthusiasm when in 1896, on a visit to Europe, he saw the first "horseless carriages." Returning to Japan, the young man's ardor was soon dampened by his elders who failed to share his interest in such a "crackbrained foreign invention."

But young Mr. Matsukata's enthusiasm for the automobile became his lifelong ambition when, for lack of a better opportunity, he entered the Tokyo Gas & Electric Co., in formation at that time.

Goro Matsukata was born in April, 1872, and was the fifth of the nine sons of Marquis Masayoshi Matsukata, all of whom have achieved success in their lines and occupy or have occupied leading positions in industrial Japan. He was graduated from the Law College of the Tokyo Imperial University in 1896 and was then sent for a tour of Europe.

Soon after joining the gas and electric company, Mr. Matsukata met Mr. Hoshiko, who was then connected with the Nippon Jidosha Co., a private enterprise of Baron Okura, Jr., another early Japanese motor car enthusiast. The firm had produced in the course of several years only one car, which never ran.

Mr. Matsukata's chance came when Japan's army chiefs decided that it would be highly desirable to have a domestic automobile industry and in 1918 promoted the Automobile Subsidy Act. Several industrial concerns began the manufacture of trucks, among them being the Tokyo Gas & Electric Co. of which Mr. Matsukata had become president and Mr. Hoshiko technical director. When the time came to license firms which were building trucks successfully, only the Tokyo Gas was able to qualify. And Mr. Matsukata became the pioneer manufacturer of motor vehicles in Japan—almost 20 years later than he had hoped.

A few years later Mr. Matsukata established the Kyodo Kokusan Automobile Co., a joint sales organization of the Jidosha Kogyo and the Tokyo Gas companies.

Mr. Matsukata is as successful a salesman as he has been a promoter of business enterprises. From his frequent trips to Manchukuo he brings back big orders for buses, trucks, airplanes and, more recently, Chiyoda and Sumida

Goro Matsukata

passenger cars. Mr. Matsukata keeps in touch with world-wide automotive developments through the weekly columns of AUTOMOTIVE INDUSTRIES.

(This is one of a series of six brief biographies of Japanese motor vehicle manufacturing executives.)

Calendar of Coming Events

SHOWS

First International Consumers' Petroleum Exposition, Detroit.....Jan. 16-24
Automobile Show, Berlin, Germany, Feb. 20-March 7
Hungary, International Automobile, Motorcycle and Motorboat Exposition, Budapest .....March
Austria, Automobile and Motorcycle Salon, Vienna .....March 7-13
Switzerland, 14th International Exposition, Automobiles, Motorcycles and Bicycles, Geneva .....March 12-21
Portugal, 11th Automobile Salon, Porto March 27-April 5
Illinois Automotive Ass'n, 4th Annual Show and Maintenance Exhibit, Navy Pier, Chicago .....Apr. 24-28
Poland, Automobile Salon—16th International Fair, Poznan .....May 1-10
Norway, Automobile Salon, Oslo..May 7-10
Second Annual Automotive Maintenance Show, San Francisco..May 20-23
Belgium, First International Aeronautical Salon, Brussels ....June 18-30
Fourth ASTM Exhibit of Testing Apparatus and Related Equipment, New York .....June 28-July 2
Poland, Automobile Salon (Foire Orientale), Lwow .....Sept. 1-15
France, 31st International Automobile Salon, Paris .....Oct. 1-17
Great Britain, 31st International Automobile Exposition, London..Oct. 14-23
National Automobile Show, New York, Oct. 27-Nov. 3
Italy, 10th International Automobile Salon, Milan .....Oct. 28-Nov. 8
Great Britain, 13th International Commercial Automobile Exposition (trucks and buses), London..Nov. 4-13
Great Britain, 36th Scottish International Automobile Exposition, Glasgow .....Nov. 12-20

CONVENTIONS AND MEETINGS

Tin Can Tourists' Winter Convention, Clearwater, Fla. .....Jan. 29-Feb. 8
Tin Can Tourists' Winter Convention, Sarasota, Fla. .....Feb. 8-14
Association of Highway Officials of No. Atlantic States, 13th Annual Convention, New York .....Feb. 24-26
American Society for Testing Materials, 1937 Regional Meeting and Committee Week, Palmer House, Chicago, March 1-5
International Association for Testing Materials, Second International Congress, London, England.April 19-24
41st Annual Convention and Exposition of the American Foundrymen's Association, Milwaukee .....May 3-7
American Society of Mechanical Engineers, spring convention, Detroit, May 17-21
American Petroleum Institute, Mid-Year Meeting, Colorado Springs, Colo. .....June 1-3
Second World Petroleum Congress, Paris, France ....late May—early June
Automotive Engine Rebuilders Association, 15th Annual Convention, Chicago .....June 21-24
American Society for Testing Materials, 40th Annual Meeting, New York, June 28-July 2

CONTESTS

Indianapolis Speedway, 500-Mile International Sweepstakes .....May 31
Pan American Cup Race, Roosevelt Raceway .....July 5
Roosevelt Raceway, 400-Mile George Vanderbilt Cup Sweepstakes....Sept. 6
Los Angeles, 500-Mile International Sweepstakes .....Nov. 28

Just Among Ourselves

(Continued from page 77)

strategy" for the industry has been operating in the present difficulties. Executives of other plants have naturally been offering sympathy and moral support to their friends in General Motors, but beyond that the principle of minding one's own business has been sincerely and consistently maintained.—H. H.

James O. Spearing

James O. Spearing, automobile editor of the New York *Times*, died of pneumonia Jan. 9 after a two days' illness. He was born in New Orleans and was educated there at the University of the South, Sewanee, Tenn., from which he was graduated in 1909.

Mr. Spearing joined *The Times* in 1913 serving as a reporter until 1918 when he was appointed motion picture critic. For three years he was in Hollywood with a motion picture concern and returned to New York in 1927 to become automobile editor of *The Times*. In his weekly column, "At The Wheel," he began a crusade for safe driving. He made many suggestions for improving the lot of the motorist and was among the first to fight filling station frauds. He also led a campaign for better roads.

Times-Wide World Photo

James O. Spearing
late automobile editor of the *New York Times*

Ford World Sales Reached 1,219,262 During 1936

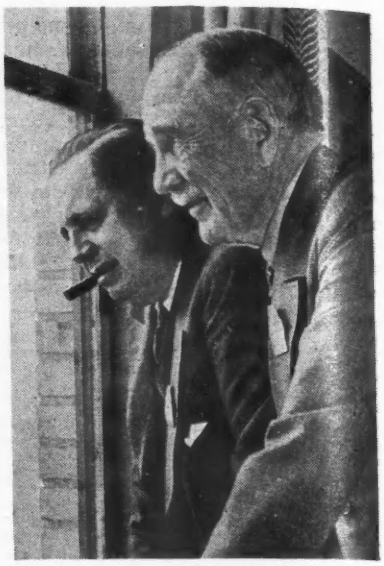
More than a million cars were again sold by the Ford Motor Co. last year, the 11th year in the past 17 with such a record, it was announced this week. In 1936, Ford cars and trucks sold throughout the world totaled 1,219,262 units. Ford world production in the same period was 1,194,800 units.

The bulk of Ford production was in the United States for domestic use. Canadian production, including assemblies in Australia, India, Malaya, New Zealand and South Africa, totaled 60,282 units. Production in the United States for export plus production in plants in Europe, Asia, and South America was 204,641 units, bringing the world production total for the year to 1,194,800.

Nash-Kelvinator Extra Voted, Five New Directors Elected

Directors of the Nash-Kelvinator Corp. met in Chicago, Jan. 12, and declared a dividend of 25 cents payable Feb. 20 to stockholders of record Feb. 1. Net profits of $1,020,707 for the Nash division for the fiscal year ending Nov. 30 were shown in the report presented by C. W. Nash, chairman of the board.

Members of the Nash board retained as directors are: C. W. Nash, chairman; C. H. Bliss, J. T. Wilson, Sewell Avery, Fred W. Sargeant, H. H. Seaman, Robert F. Herrick and Emory W. Clark. New directors elected are: Percy J. Ebbott, vice-president of the Chase National Bank, New York; H. G. Perkins, of Detroit; Harlan T. Pierpont, of Worcester, Mass.; Ernest Stauffen, Jr., vice-president of the Manufacturers Trust Co., New York; and Merlin Wiley, of Detroit. All were members of the Kelvinator board.



International News Photo

G. W. Mason (left), president, and C. W. Nash, chairman of the board, Nash-Kelvinator Corp., which declared its first dividend this week.

SAE Annual Meeting

(Continued from page 69)

ing, at which Dr. Hugo Eckener, chairman of the German Zeppelin Transport Co., was the scheduled speaker. Presentation of Vincent Bendix trophies to Louise Thaden, Blanches Noyes, Laura Ingalls and William Warner rounded out the banquet.

Thirty-two exhibitors displayed engineering developments at the S.A.E. engineering display held in connection with the meeting and arranged by F. L. Faurote.

(Reviews of a number of papers presented to the SAE begin on the following page.

1936 GM Shipments, 2,037,690

Last Year's Sales 18.8% Above Those of 1935; December Shipments Totaled 239,114

December shipments of General Motors cars were not affected by the wave of strikes that had closed a dozen of the company's plants at the end of the month. December sales to dealers in the United States and Canada, together with shipments overseas, totaled 239,114 compared with 185,698 in December a year ago. Sales for 1936 totaled 2,037,690 compared with 1,715,688 in 1935, an increase of 18.8 per cent.

Sales of General Motors cars to consumers in the United States totaled 173,472 in December compared with 122,198 in December a year ago. Sales in November were 155,552. Sales for 1936 totaled 1,720,213 compared with 1,278,996 in 1935, an increase of 34.5 per cent.

Sales of General Motors cars to dealers in the United States totaled 197,065 in December compared with 150,010 in December a year ago. Sales in November were 156,041. Sales for 1936 totaled 1,682,594 compared with 1,370,934 in 1935, an increase of 22.7 per cent.

The accompanying table gives further details of General Motors sales.

	December, 1936	November, 1936	December, 1935	Twelve Months, 1936	Twelve Months, 1935
Sales to world dealers	239,114	191,720	185,698	2,037,690	1,715,688
Sales to U. S. dealers	197,065	156,041	150,010	1,682,594	1,370,934
Sales to U. S. consumers	173,472	155,552	122,198	1,720,213	1,278,996
Change in U. S. dealer stocks	+23,593	+489	+27,812	—37,619	+91,938
Sales to foreign dealers	42,049	35,679	35,688	355,096	344,754

Inquisitorial Engineers Acquire New Ideas

From Speakers at the Annual S.A.E. Meeting

Some of the papers, presented in Detroit, of particular interest, have been abstracted in the following pages. Others will be printed in subsequent issues

Cylinder Wear Gets "Going Over"

IN a paper on cylinder-bore wear, Max M. Roensch of Chrysler Corporation listed three causes of such wear, as follows:

1. Abrasion—Wear due to foreign particles in the oil film.

2. Erosion—Wear due to metal contact between the pistons or rings and the cylinder bore.

3. Corrosion—Oxidation or chemical action on the cylinder walls, pistons, and piston rings by the products of combustion.

While under ordinary conditions the order of importance of the three causes is that in which they are given, such factors as conditions of operation, design of engine, design of air cleaner, piston and ring equipment, and lubricating oil used may change the order.

Abrasives may get into the engine in any of the following ways:

1. Core sand, cast-iron filings, chips and dirt may remain in the engine after the cleaning and washing processes in the factory.

2. Valve-grinding compound or cylinder-honing residue may be left in the engine.

3. Road dust may enter the crankcase with the ventilating air.

4. Most important of all is the road dust entering through the intake system.

With cars operating on paved roads without effective air cleaners the cylinder wear has been found to be about 25 per cent less in winter (when there is less dust) than in summer. The almost universal adoption of the oil-bath type of air cleaner has been the greatest factor in reducing cylinder wear from this cause, as the new cleaners remove from 95 to 97 per cent of the dust over a wide range of air velocity. In a test made in the Southwest, the average rate of cylinder wear in a car fitted with a copper wool-filled air cleaner was 0.002 in. in 5000 miles, while the same car fitted with an efficient oil-type cleaner showed only 0.0005 in. average wear in 10,000 miles, a rate only one-eighth as great. Dust taken in with the carburetor air is very destructive, as it gets directly into the oil film and wears the piston rings and bores.

The rate of cylinder wear is affected by the cylinder-block hardness and alloy content, the piston-ring line-up and ring design, and the piston material and design. While soft and porous cylinder blocks generally are subject to abnormal wear whether dirt is present or not, within the range encountered in regular practice (180—220 Brinell) hardness is a minor factor. However, under dusty conditions the wear is definitely less on centrifugally-cast liners of about 500 Brinell than on the normal cylinder block of about 200 Brinell.

An increase in the width of piston rings and a decrease in their specific pressure reduce the rate of cylinder wear. Also, under normal conditions the cylinder wear is less with cast-iron than with aluminum pistons, but no data are available as yet regarding cylinder-bore wear with the new cast-steel pistons. The best precaution consists in keeping the dirt out of the engine; the rapid improvement in air cleaners during the past few years leads one to consider this to be within the realm of possibility.

Assuming the engine to receive clean air, the next cause of wear to be considered is what has been referred to as erosion or what is usually called scuffing when light and scoring when

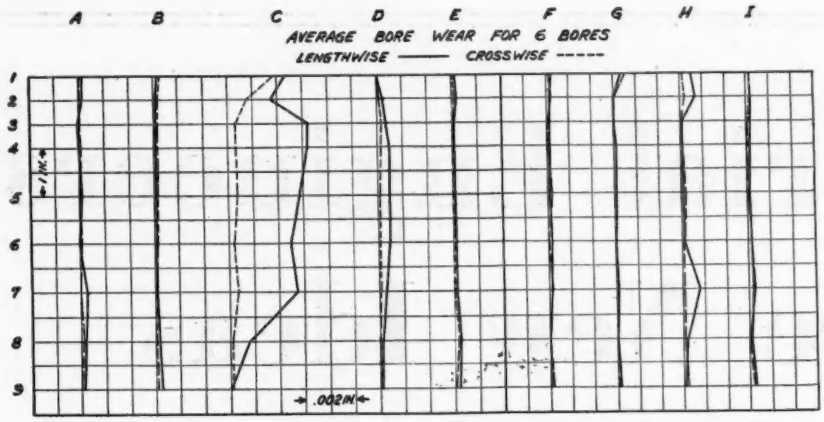


Fig. 1—Mr. Roensch plotted the effects of piston design to show the average bore wear for all six cylinders during nine 4000-mile tests

severe. Here the rings or pistons break through the oil film or run where no oil film exists. The result is metal-to-metal contact, which causes wear on both parts. This metal-to-metal contact may be due to any or all of the following conditions:

1. High spots on the cylinder wall caused by mechanical and thermal distortion.
2. High temperature of cylinder wall which burns off the oil film.
3. Piston rings which do not give uniform wall pressure or too high wall pressure.
4. High spots on the piston which create high pressures and dry up sections of the cylinder wall.
5. Lubricating oils of low film strength which break down under load.
6. Oil not present at all or washed off with gasoline or water, as during cold starting and warming up.

Liner or cylinder material is a factor, of course, and Mr. Roensch observed in this connection that if engine manufacturers had spent as much effort on cylinder irons as leading ring companies had spent on their materials, we would have better cylinder blocks. Tests had shown a 50 per cent increase in cylinder-bore life to result from small additions of copper. Nickel, chromium and molybdenum all improve the cylinder material, but few performance data are available on the subject.

The effect of cylinder-block design in preventing thermal distortion is shown by comparing the bore wear in a six-cylinder engine with short jackets and no distributor, with that of a later design using a header and having long jackets. In the former there was considerable wear at the top ring in all cylinders except No. 1 (which is particularly well cooled on account of the proximity of the water inlet). Where the bottom of the water jacket joins the cylinder wall there was considerable trouble from piston seizures. In a similar engine with long water jackets and a water-distributing tube the bore wear under the same test conditions was practically negligible.

Provided the engine is properly cooled, load and speed seem to have very little influence on bore wear. Two eight-cylinder cars driven at full speed over 15,000 and 25,000 miles, under test conditions, showed average maximum bore wears of 0.00064 and 0.0011 in. respectively; under normal operating conditions in the hands of the owner the wear would be from two to five times as great, which brings out the favorable influence of continuous running.

Fig. 1 shows the effects of piston-ring design. Here are plotted the average bore wears for all six cylinders during nine 4000-mile tests with the same engine but different piston-ring combinations. Only three combinations show appreciable wear. With combination *C*, excessive wear occurred over the oil-ring travel, owing to the high specific pressure of these rings, which caused them to break through the oil film and to allow so little oil to get to the top ring that excessive wear occurred there also. Set *H* shows excessive wear only at the top and bottom of ring travel, which was undoubtedly caused by ring vibration at the end of the stroke. In general, good oil economy and low wear go together, provided the economy is not obtained by starving the bores or the rings. Generous amounts of oil must be fed to the bores and the pistons at all times, and the piston skirt and oil rings must be depended upon to keep the oil out of the combustion chamber.

Scuffing conditions are worst during the warming-up period after a cold start. The piston warms up much faster than the cylinder wall, and therefore gets larger than the bore. In some cases (see Fig. 3) a conventional untreated aluminum piston actually pulled cast iron right out of the cylinder bore, and the resulting roughness of the bore caused the rings to scuff. A great improvement in this respect is effected by anodizing, which not only makes the surface of the aluminum piston much harder, but makes it porous so it will retain oil. Tin plating of both cast iron and aluminum pistons also prevents scoring, the tin acting as a metallic lubricant under conditions of high pressure.

Corrosion naturally is worst when the engine is cold, and under low-speed, low power-factor operating conditions, such as occur in milk-trucks and similar vehicles. From the amount of water that goes into the crankcase during the first five minutes after a start at minus 10 deg., conditions must be as though it were raining on the cylinder walls. As there is only a thin film left on the cylinder walls from

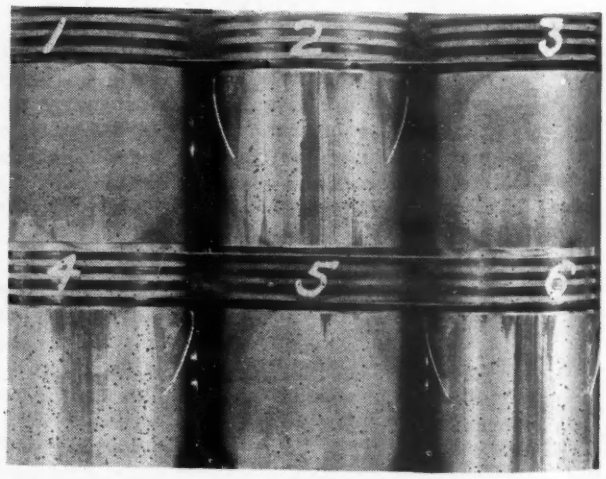


Fig. 2—Cold scuffing test with 20 cold starts at minus 10 deg. Fahr. were made with these cylinders in use. Nos. 1-3-5 were anodized Nos. 2-4-6 were untreated. A comparison pointed out by Max M. Roensch

the previous warm-running period, this is soon washed away.

A number of solutions for this problem are being considered, involving both engine design and lubricating oil characteristics. The use of light oils, which get into circulation very rapidly, is believed to be one of the best solutions for this condition, coupled with the use of good thermostatic control maintaining fairly high jacket temperatures even under very low temperature operating conditions. Supplying oil to the cylinder bores under pressure, as is being done by one manufacturer, is to be watched with considerable interest. Real progress in the attack of this problem can only be made with a more careful study of the variables encountered.

In concluding his paper the author suggested that a committee be appointed, under S.A.E. auspices, to collect bore-wear data for all conditions of operation, composed of engineers in a position to obtain such data.

Altitude-Knock-Test Methods

THE development of an "altitude-knock-test method" was discussed in a paper by W. M. Holaday and G. T. Moore of the Standard Oil Co. (Ind.)

Ever since the adoption of the A.S.T.M. Motor Method, laboratories located at high altitudes have had difficulty in obtaining correlation with those operating at or near sea level. The deviations have been influenced by the type of fuel tested and the altitude at which the laboratory operates. In general the more sensitive fuels have shown the greater differences.

When operating the C.F.R. engine in accordance with the A.S.T.M. test procedure at high altitudes, the operating conditions are not the same as those used at sea level. At the higher altitudes the density of the air is reduced, and when testing a fuel of a given octane number it is necessary to use a much higher compression ratio than at sea level. At 5000 ft. altitude it is necessary to increase the compression ratio about 0.9 over that required at sea level to obtain the same compression pressure and knock intensity. Increasing the compression ratio to obtain the same compression pressure results in the spark being advanced over that used at sea level and in the shape of the combustion chamber being radically altered. It has been generally assumed that standardization of compression pressure and knock intensity, with no regard to the compression ratio, was all that was necessary to bring about correlation between engines operated at reduced barometric pressures with those operated at sea level. This erroneous assumption has been partly responsible for the variations in results obtained on cooperative samples tested at various altitudes.

To use the Motor Method successfully at high altitudes it is suggested to change the present method of operation so as to increase the volume of air admitted to the cylinder until the compression pressure at a given compression ratio is equal to that obtained at sea level. The most general method used to increase the density of the air entering the cylinder is to super-charge. Compressing the air entering the cylinder does not readily lend itself to routine testing with the C.F.R. engine. However, if the restriction in the present carburetor and manifold system is diminished the effect of forced induction is obtained. This can be accomplished by eliminating the throttle plate and by enlarging the venturi. At 5000 ft. the use of a ⅞ in. venturi, instead of the conventional 9/16 in. venturi, allows the same compression pressure at a given compression ratio as is obtained at sea level using the standard equipment.

A number of knock rating tests have been conducted during the past year to criticize this test method. While the tests that have been conducted in one laboratory using a special altitude test unit have shown that the method will give good correlation, and that two laboratories using the method for the past six months correlate with engines operating at or near sea level, the two series of cooperative altitude tests conducted to date do not yet prove that the proposed method will improve the correlation or reduce the experimental error.

Engine Temperature Control

"FACTORS in Engine Temperature Control" was discussed by H. E. Winkler of Schwitzer-Cummins Co. He said that localized hot spots, which are the cause of much of the complaint about rings, pistons and oil consumption, change in importance with the throttle setting and engine speed. An interesting case of a European engine was cited, in which there was known to be hot spot at the upper end of the cylinder barrel and in which the injurious effects seemed to decrease as the engine speed and power output increased. It was found that at low engine speed the water in this part of the jacket was stagnant, but with increase in speed it flowed with considerable velocity. This higher water velocity naturally increased the heat-dissipating capacity of the cylinder wall and thereby prevented it from reaching excessive temperatures. The need, therefore, is for high water velocities in the case of narrow passages and wide passages in the case of low velocities.

While consideration of production, service and cost problems generally makes it necessary to compromise with ideal cooling conditions, much can be done to improve matters. Full-length water jackets, sufficient space around valves and between valve centers, sufficient distance between cylinder-barrel centers, and minimum areas of walls with hot gases on one and coolant on the other side are some of the factors that improve cooling conditions.

If water is used as coolant, the temperature rise in the engine is equal to the quotient of the B.t.u. absorbed by the pounds of water circulated in a given time. On the other hand, if a 50 per cent alcohol solution is used, which has a specific heat of 0.8 and a specific gravity of 0.9, the rate at which heat is carried away is only 72/100 times as great and the temperature rise through the engine will be approximately 40 per cent greater. Since the pump capacity in volumetric measure is less with the light solution, the temperature rise through the engine is still further increased. It is fortunate that this solution is used in winter time when the low atmospheric temperatures ease the cooling problem.

The rate of heat transfer from radiator to air is nearly proportional to the difference between the average radiator temperature and the average air temperature. A low-capacity pump may produce a drop of 20 deg. through the radiator core. If the water circulation is doubled and the temperature drop in the core thereby reduced to 10 deg., the top-tank temperature is lowered by 5 deg. This increased cooling effect is obtained at quite low cost,

but if the rate of circulation is further increased, the law of diminishing returns makes itself felt; a drop of 10-12 deg. seems to be the commercial optimum and occurs in the majority of modern vehicles.

Some difficulty has been caused by the corrosive effects of commercial coolants. When iron corrodes it replaces some other radical, and in the case of corrosion under water it replaces hydrogen. This hydrogen is deposited as a film on the iron surfaces and would prevent further corrosion were it not for the fact that it is scrubbed off by the flowing water. Whenever the coolant is allowed to become aerated, the hydrogen film is removed by oxygen dissolved in the water, and this promotes the rusting action. Rust so formed is deposited throughout the cooling system, and the cooling efficiency then falls off. Since the water enters the pump in its most aerated form and the impeller blades get little protection from a film, which cannot form because of the high velocity of these parts, trouble from impeller corrosion has been frequent. Cooling solutions or mixtures of an oily nature greatly retard engine and impeller corrosion. With water and solutions of alcohol the pump packing or seal should exclude air from the system as far as possible. While the use of a bronze impeller prevents corrosion of impeller blades, it does not reduce trouble from rust deposits in the radiator core.

Several years ago there was a rather sudden change in the pump location from the side to the front of the engine, where the pump is combined with the radiator fan. Unfortunately, these fan-pump units often had less satisfactory bearings, and limited space also often prevented a good stuffing-box design. Resulting service troubles caused several manufacturers to return to the side-mounted pump, while the rest, in the words of a well-known engineering executive, changed every six months to get away from bearing and stuffing-box trouble. During the past few years, however, there has been much improvement in both fan-pump units and side-mounted pumps and thoroughly reliable pumps of both kinds are now available, many of them equipped with automatic seals instead of the conventional packing.

It has been found by research work that a successful seal design must meet the following requirements:

1. The pump shaft must revolve on its axis and continue to do so. This means anti-friction bearings or an excellent plain-bearing construction.

2. The sealing face must be driven positively in the plane of the seal. This is necessary to avoid "lifting" and chattering.

3. Seal face materials inside the pump must operate without lubrication, in any coolant, without appreciable wear.

4. Sealing-face pressures must remain within predetermined limits. This means that members of the seal assembly must not adhere or "stick" to the pump shaft. Such stickiness makes the sealing pressure erratic, which, in turn, produces erratic seal operation.

5. The sealing arrangement must not leak an appreciable amount of air. This usually means rather high sealing pressures, which further emphasizes the need for free movement of sealing members made of the proper materials.

The paper also included considerable data on fan capacities, power consumptions, etc.

Atmospheric Change—A Problem

THE problem of correcting engine performance for atmospheric variations is more difficult in the case of the Diesel than in that of the Otto-cycle engine, chiefly because Diesel engines are being operated over a wide range of fuel-air ratios, while in Otto-cycle engines the ratio is held at or near a fixed value. Also, in the case of Diesel engines atmospheric changes tend to alter the fuel-air ratio, because such engines are generally operated at a fuel rate fixed by the adjustment of a mechanical injection system. Another factor which makes the problem more difficult is that the combustion process in the compression-ignition engine is more sensitive to atmospheric changes than in the Otto-cycle engine, unless the latter is on the verge of detonation.

In order to add to the rather limited amount of experimental work which has been done in this field to date, the effects of variations in inlet pressure and temperature on engine output were determined for a single-cylinder, sleeve-valve, compression-ignition engine in the Sloan automotive laboratory of Massachusetts Institute of Technology. The work was done by two students at M.I.T., O. B. Randell and J. E. Talbert, and a paper on the methods of test, re-

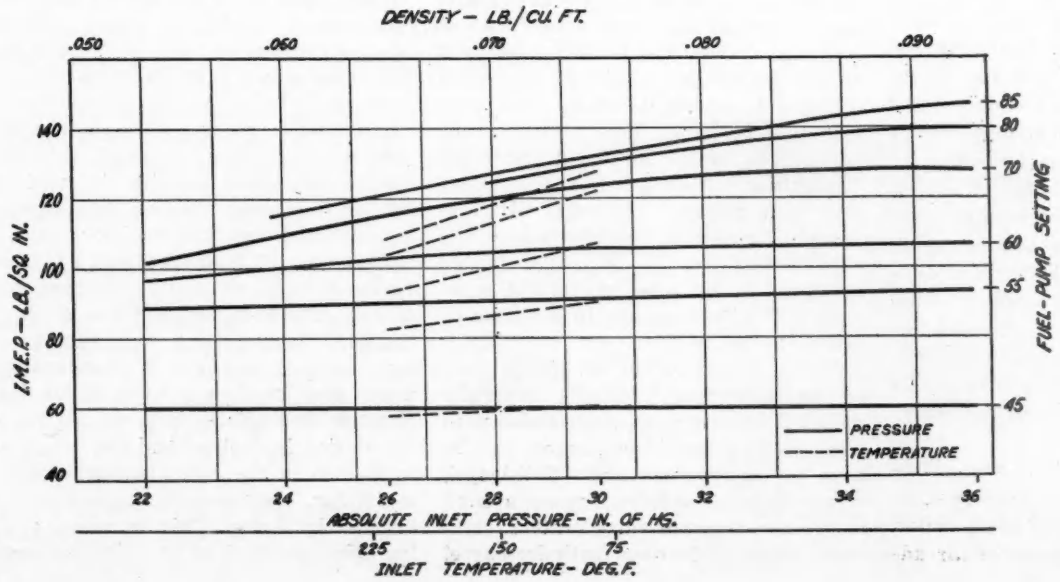


Fig. 1—Prof. Taylor presented a graph to show the effect of inlet pressure and inlet temperature on the indicated mean effective pressure at various fuel-pump settings using an M.I.T. sleeve-valve compression-ignition engine at 900 r.p.m.

sults obtained, and conclusions drawn therefrom was presented at the meeting by Professor C. Fayette Taylor.

Temperature variations were secured by varying the current supplied to an electric heater in the inlet system. Pressure variations were secured by throttling the inlet air or supercharging by means of a separately driven pump.

Fig. 1 shows the variation of the i.m.e.p. with variation in inlet density at various rates of fuel flow. It will be noted that the results are not the same when the density is varied by changing the temperature as they are when the density is varied by changing the pressure. It will also be seen that the effect of both temperature and pressure increases as the fuel rate is increased. This would be expected, for when there is a large amount of excess air the energy of the fuel-air mixture varies almost directly with the quantity of fuel, so that when this is held constant by the fuel-pump setting, the effect of pressure and temperature changes on the i.m.e.p. is small. Not so when there is little excess air.

If it is assumed that the i.m.e.p. varies directly with the air density, the product of the i.m.e.p. and the absolute temperature should be constant, but a plot of these factors from the test results showed that there is a definite tendency for the product to increase with the inlet temperature. This, Professor Taylor pointed out, may be due to improved volumetric efficiency, a better timing of the peak pressure, or both.

In considering results of such tests as those discussed here, it must be remembered that the change in performance with a given change in inlet conditions depends to a considerable extent upon the injection timing used. For example, if the timing is set late (to keep down the maximum pressure) an increase in temperature or pressure will have the effect of improving the performance by reducing the delay, entirely apart from any other effect. On the other hand, if the injection is timed for best power, or earlier, the advance in effective timing due to an increase in inlet pressure or temperature will be detrimental.

While no definite proposal for a correction factor or formula was made, the author stated that at a constant air/fuel ratio the performance of a Diesel engine varies in a manner generally similar to that of the Otto-cycle engine, and he expressed his belief in the possibility of developing approximate empirical formulae for the correction of Diesel-engine performance to standard atmospheric conditions at a given fuel/air ratio.

More Regarding the "Knocks"

UP to recently, straight-run intermediate reference fuels were used in engine development work, but this practice has now been discontinued, according to John M. Campbell, Wheeler G. Lovell and T. A. Boyd of General Motors Corporation, Research Laboratories Section, who presented a paper on "Factors Affecting the Relative Knocking Characteristics of Motor Fuels in Service." It appeared from the paper that engines can be built to operate on a straight-run fuel without "depreciating" that fuel, that is, as free from detonation as its octane number determined by comparison with the straight-run reference fuel would lead one to expect; or, again, the engine can be built to operate without "depreciating" a fuel whose octane rating has been determined by comparison with a very highly cracked reference fuel. The objection to such reference fuels is that they differ from the fuels in regular use. If a reference fuel is being used which is an average of commercial gasolines, then an engine can be built for this fuel and it will be found that insofar as engine speed affects the knock ratings, some fuels "depreciate" a little while other "appreciate" a little and the spread will not be very great. This is substantially what is now being done in practice.

In any particular engine the speed at which detonation is most pronounced may be changed by changing the spark timing curve. This is illustrated in Fig. 1, in which intensity of knock is plotted against car speed and spark advance against car speed. The data are from an L-head engine of a 1934 car. With the standard spark curve the cracked fuel showed a high-speed knock which was completely absent at speeds below 35 m.p.h. By retarding the spark at high speeds this high-speed knock was eliminated. Then, when the entire spark curve was advanced from an initial setting of 2 deg. to an initial setting of 8 deg. in order to produce knocking, maximum knock on the cracked fuel occurred between 25 and 30 m.p.h. and the apparent road-knock rating was raised from an octane number of 66 with the standard spark advance, to an octane number of between 75 and 80 with the modified spark timing. A 100 per cent cracked gasoline and a commercial blend showed the following ratings according to different methods of determination: C.F.R. Research method, 79.9 and 71.5; A.S.T.M. method, 70.7 and 69.3; road test, standard spark curve, 66 and 68; road test, modified spark curve, 80 and not determined.

It is thus seen that the apparent depreciation of cracked gasoline with respect to straight-run reference gasoline can may be controlled to a certain extent by controlling the speed for maximum knock. This can be accomplished by a suitably regulated spark-timing curve.

Another factor which may affect the apparent depreciation of fuels in cars is the mixture ratio. Referring to Fig. 2, with a mixture ratio of 14:1 the cracked gasoline was equivalent to a reference fuel of 80 octane number,

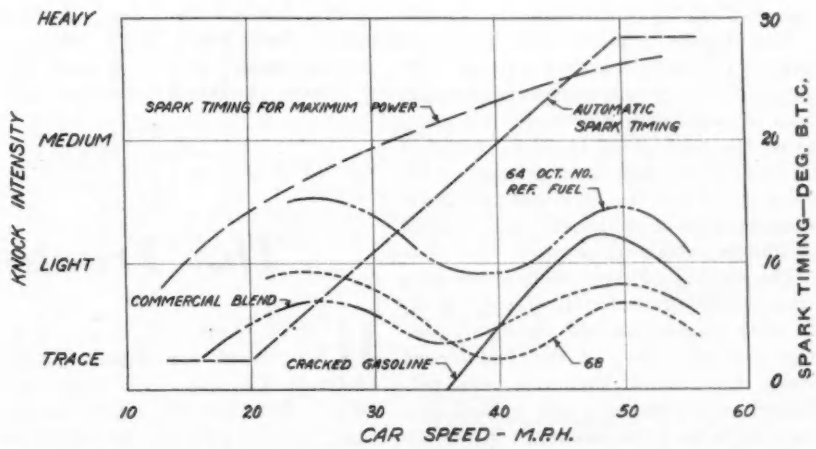


Fig. 1—With the paper on Factors Affecting Knocking Characteristics a graph compared the knock characteristics of two gasolines in a 1934 production car

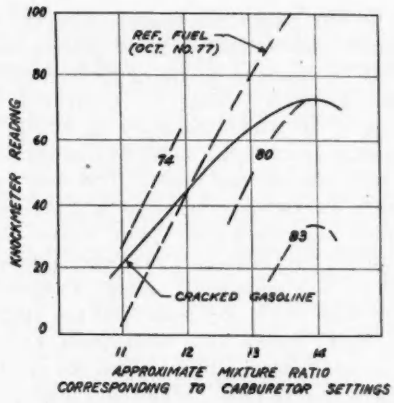


Fig. 2—Effect of carburetor setting on the knock rating of a cracked gasoline was shown by the men from the GM Research Laboratories Section

while with a mixture ratio of 11:1 it was equivalent to a reference fuel of only 74.5 octane number. Thus an apparent "depreciation" of 5.5 octane numbers was brought about by enriching the mixture from a 14:1 to an 11:1 ratio. It is theoretically desirable, of course, from the standpoint of economy, to have cars operate on as lean a mixture as possible, and advances in that direction would tend to reduce the apparent "depreciation" with respect to straight-run fuels. In addition, these changes would increase the tendency to knock beyond that of the presently used richer mixtures.

In certain cases the volatility may affect the knocking characteristics of a fuel on the road, and this is believed to explain the fact that benzol blends almost invariably appear better in road tests than would be expected from their laboratory knock rating. The explanation is as follows: During acceleration at wide-open throttle, a wet mixture is being delivered to the engine, and the distribution is very non-uniform. Whatever knocking occurs would be expected to originate from charges which are on the lean side of the average. However, if the fuel contains a relatively large amount of benzol, which is comparatively volatile (boiling point 176 deg. F.) then the lean cylinders will receive a fuel which is richer in benzol than the original fuel. Then, owing to the greater anti-knock effect of the benzol, these lean charges will have less tendency to knock than they would if the fuel they contain were conventional gasoline of the same laboratory knock rating.

Integral Chassis-Body

DEVELOPMENTS in the rolling industry have made it possible to produce sheets wide enough for an entire automobile-body side panel or roof panel to be stamped from them, said Edward G. Budd in a paper on "The Aircraft Trend in Body Structural Design." Previous to this development, sheets of the required width could be produced only by flash-welding narrower sheets together. Press builders also have contributed their share to the advance of the body-building art, by providing larger presses with increased power. The all-steel bodies thus made possible have greatly increased the stiffness of the entire structure. In many cases the roof panel could be made of thinner stock than that actually used, were it not for the fact that the metal must be able to withstand the stresses of the deep-drawing process.

The welded all-steel shell needs very little reinforcement. However, along the door header, around the door openings and windows, at the instrument board and along the sills, channel-shaped reinforcements are welded into place to form a box section. These reinforcements are designed so that the trim strips to which the upholstery is fastened are readily and quickly inserted, and firmly held. The whole design of the reinforcements is aimed at making it commercially practical to perform the necessary operations of assembling and welding, with the welds placed where they will either be covered, or readily finished so as to be invisible when the body is painted.

Streamlining, a necessity in aircraft design, became a no less compelling force in automobile-body design, on account of the appreciation of the buying public for flowing lines. Fortunately, sheet steel lends itself exceptionally well to the production of such lines.

One of the latest developments in the automobile field is the integral construction of body and chassis members, which entirely eliminates the separate chassis frame. There is little doubt that the public's attitude toward this new type of construction will be favorable, but it must be considered also from the standpoint of commercial practicability. One of the greatest advantages of all-steel bodies, as compared with the composite type, is that the former can be built in completely assembled and finished units which can be economically transported to the automobile manufacturer's assembly plant and assembled into the complete body in a period measured in minutes. Development of the integral construction of body and chassis will further simplify assembly problems and at the same time give the customer the full advantage of the all-steel construction.

Several foreign manufacturers already have adopted this system of construction for their regular production. Numerous experiments along the same line have been carried out in this country, but no large-scale production has developed as yet. If the system is adopted, the powerplant will have to be assembled after the principal unit has been built, finished and trimmed with upholstery and hardware. In assembling the axles and powerplant to the body, workmen therefore will have to be careful not to injure the body finish. While the new construction may result in a saving in weight, this will be very small. As to costs, a conventional chassis frame can be produced for from $9 to $15, and Mr. Budd thought that some very close figuring would have to be done to make it possible to furnish a combination body-and-chassis unit at from $9 to $15 above the present body price.

The author concluded his paper by voicing the opinion that there are many obvious advantages in the type of construction referred to, and while its adoption would be a radical step for the automobile industry to take, so was the adoption of wide chassis, steel roofs, and short cowls with long hoods, which are accepted practice today.

The Tractor Has a Future

HARRY G. DAVIS, Director of Research of the Farm Equipment Institute, Chicago, in a paper entitled, "The Cavalcade of Farm Mechanization," gave a philosophic outline of the development of agricultural machinery and of its effects on the farming population and the Nation in general. As to the outlook for the farm implement and tractor industry, he said that those who had delved into the problem felt that the industry was still in its swaddling clothes. There were new jobs to be done by the tractor and its accompanying equipment, as well as old jobs to be done in a better and more

economical way. Most of the basic problems of design and production had been solved satisfactorily, and the main task now was the application of these power units to machines which will perform these jobs.

Sales possibilities may be gaged by the fact that there are about three million farms of 50 acres and over that are not yet using mechanical power. There are a million more that are smaller but sufficiently large to justify the purchase of one of the smaller tractor models placed on the market in recent years. In the corn belt alone there are about a million larger farms that can supply enough work for two tractors, a large one for plowing, disking and other heavy jobs, and a small one for cultivating, mowing hay, and other light tasks. Many of these farms are now being so equipped. There are 1,200,000 tractors on farms which on Jan. 1, 1936, averaged more than seven years, and many of these will shortly be replaced. Many units also will be sold to other industries and for highway construction and maintenance.

Test Diesel Fuels in New Way

SOME new equipment for use in testing Diesel fuels was described in a paper by Lt.-Commander R. F. Good, U. S. Navy, which covered an extensive study of fuels for Diesel engines used by the Navy.

Ignition-delay measurements were made from simultaneous recordings of crankshaft angular velocity, start of injection, and start of cylinder-pressure rise following ignition, all of which were made with a magnetic-type, two-element oscillograph. The time axis of the oscillograph is produced by an oscillating mirror operated in synchronism with the test unit. It may be driven from the engine directly by shafting, but in that case some vibration is transmitted and errors are introduced by periodic variations in shaft flexure. To overcome these difficulties, advantage was taken of means provided for synchronizing the mirror for the study of electrical wave forms. Primary drive is provided by a 110-volt, variable speed, A. C. motor, equipped with a six-pole synchronizing disc rotating in the field of a synchronizing coil. The coil was energized three times per engine cycle from the 230-volt D. C. supply mains by using a set of automobile ignition contact points and a three-lobed cam on the engine crankshaft. The A. C. motor is brought to approximately synchronous speed by manual control and then held in phase with the test engine by energizing the synchronizing coil. With this arrangement, oscillograph/engine speed ratios of 1:2, 1:1, or 2:1 can be obtained. The 1:1 ratio, which makes about one-half of the cycle visible on the viewing screen, gave the best results in practice.

Phase location of cyclic events with respect to crankshaft angular position was accomplished by mounting a permanent magnet, surrounded by an induction coil, adjacent to the path of the flywheel bolt heads. As each bolt head passes the magnet, a small instantaneous electromotive force is induced in the coil. The two bolt heads nearest firing center were turned down to sharpen the timing impulses induced by them and so distinguish them from the other six. The coil was so mounted that these impulses occurred 32 deg. before and 13 deg. after firing center, in order that the injector valve motion, recorded on the same galvanometer, would not be partly obscured.

The exact start of injection could not be recorded directly, as it was not practicable to insulate the injector valve from its seat. The arrangement adopted was such that the valve closed an electrical contact after it had moved 0.013 in. Energy for this circuit was obtained from a three-volt dry battery. Details of the various circuits are given in Fig. 1.

The point-of-ignition pressure rise indicator developed for this test is illustrated in Fig. 2. The motion of a diaphragm in communication with the engine combustion chamber varies the air gap of a permanent magnet surrounded by an induction coil. The diaphragm used consists of two hardened alloy-steel laminations, each 2 in. in diameter by 0.050 in. thick. Magnet pole piece and diaphragm cage are of hardened tool steel. The cage is copper jacketed for water cooling. The coil consists of 3200 turns of No. 31 magnet wire and has a resistance of 120 ohms. The unit is initially magnetized by momentarily applying 230-volts D. C. to the coil terminals. In use, the coil is short-circuited across the second oscillograph galvanometer. By varying the relative inductance and capacity of this circuit, the resulting diagram may be made to represent pressure, rate-of-pressure-change, or combination of the two. For illustrative purposes,

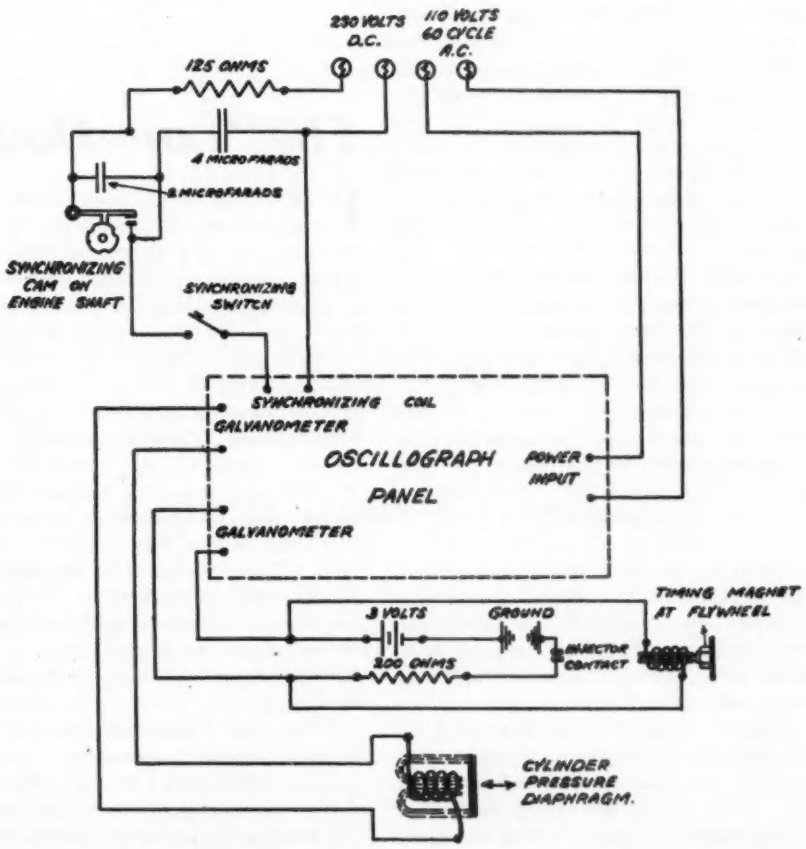


Fig. 1—Diagram of Oscillograph circuits used by the U. S. Navy

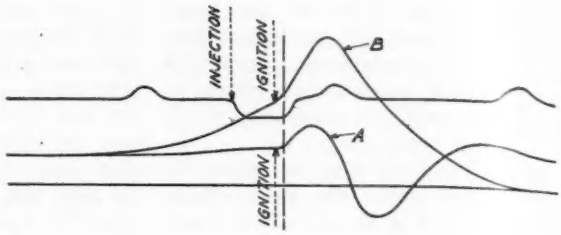
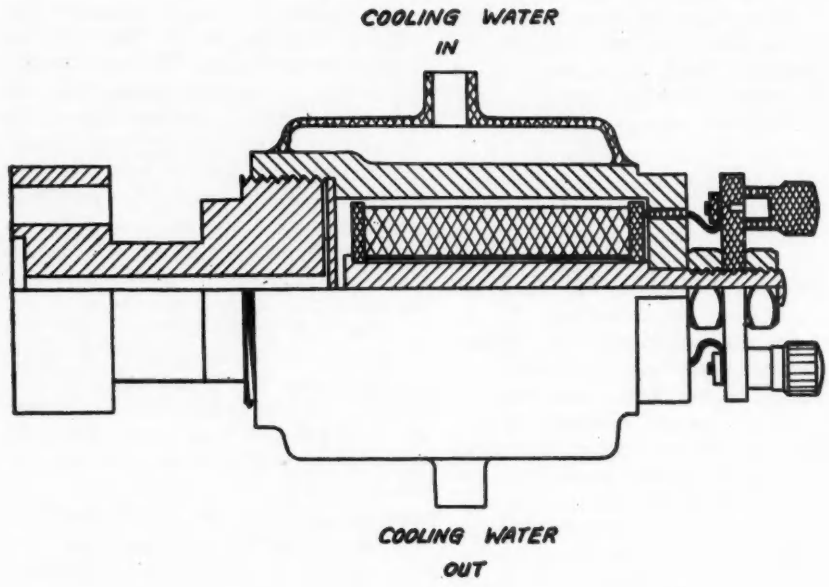


Fig. 3 — (Above) Oscillogram showing rate-of-pressure-change (LineA) superimposed on approximate pressure-time diagram (Line B)

Fig. 2—(Below) The Navy point-of-ignition indicator



the diagrams selected approximate the conventional pressure-time curve, but with sufficient influence from the rate-of-pressure-change to emphasize slightly the points at which significant cyclic events occur. An oscillogram with the rate-of-change line superimposed on the approximate pressure-time line is reproduced in Fig. 3. The oscillograms were used solely to determine the ignition delay in crank-angle degrees. From this and the known engine speed the delay in seconds can be computed.

Another factor discussed in the paper was the computation of combustion knock. The consumer of Diesel fuels (said Commander Good) is concerned with their effects, principally with smoothness of combustion and with the specific fuel consumption, because reductions in the repair and fuel bills come respectively from smooth and efficient combustion.

As an arbitrary yard-stick by which to measure smoothness of combustion, the computed combustion knock, first proposed by Joachim, has much to recommend it. The definition of computed combustion knock is built up from two subordinate definitions: the explosion pressure rise, described as the first fast increase in pressure resulting from the rapid combustion of that part of the fuel charge deposited in the engine cylinder during the ignition delay period; and the burning rate, defined as the explosion pressure rise divided by the interval, expressed in crankangle degrees, during which this phenomenon occurs. Computed combustion knock is the product of explosion pressure rise and burning rate divided by 10 to the fourth power:

$$CK = \frac{EPR \times BR}{10^4}$$

The arbitrary number thus obtained is not in itself significant. It is as a basis for comparisons between fuels that it acquires value, for it shows relatively the effects of the compared fuels on the service engine.

The "Low-Down" on Diesel Trucks

IN a paper on "Diesel Engines in Trucks," B. B. Bachman of The Autocar Co. gave operating data on 22 Diesel trucks which had been driven an aggregate mileage of 750,000 in 3933 truck days, which gives an average of 190 miles per truck per day. He pointed out that most of the Diesel units built by his company had been sold on the West Coast. Diesel-operating conditions apparently are more favorable in that territory, and the results obtained there have been more satisfactory than in the East. The following were offered as possible explanations of this state of affairs:

1. Limitations on weight and size are not as severe as in the East.
2. The length of haul is greater on the average.
3. For this reason the cost of fuel assumes greater importance.
4. The differential between the costs of fuel oil and gasoline is greater.
5. Fuel oils marketed on the West Coast may be more satisfactory.
6. Climatic conditions may be more favorable.
7. The need for low cost may have prompted operators to give closer study to Diesel requirements.

Aside from the above, it is a fact that West-Coast operating organizations have fostered many of the important developments in truck transportation. Whether this is due to a more venturesome nature or to the conditions in which they find themselves is debatable, but the fact is not. By far the larger number of Diesel units in service in this country are operated on the West Coast, and the industry producing such units is indebted to these pioneers, who have pushed the proposition with great determination.

Referring to statements made in an earlier paper on the same subject, the author drew the following conclusions from the results of operations presented in this one:

1. That Diesel trucks will weigh more and cost more than gasoline trucks is

still true and promises to be for some time.

2. The equipment requires different treatment, but the requisite technique is being rapidly acquired.

3. From the best data obtainable, maintenance is greater for Diesel than gasoline engines. How much is not yet known definitely. However advance in design and construction is rapid and should act to reduce this difference.

4. The relative time or mileage to the overhaul period has not been established.

5. A 50 per cent reduction in fuel consumption is still a fair estimate.

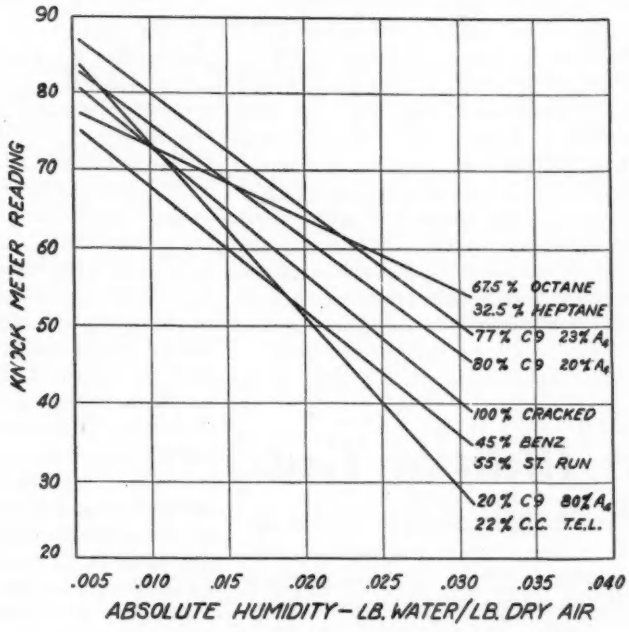
6. Oil consumption is about equal, but the need for careful attention to draining and to filter elements is important.

7. The method of driving is important.

8. The success of changeovers depends on giving careful attention to details.

9. Savings from the cost of fuel are certain, because the consumption is less, but against this maintenance and revenue must be checked. Maintenance costs will undoubtedly improve, and revenue will be affected least where it is possible to haul heavy loads. Therefore, success is most certain where hauls are long and loads can be heavy.

To Measure Knocking Tendencies



Mr. MacGregor showed the influence of humidity on detonation of typical fuels

IT has long been known that atmospheric humidity directly affects the detonation in any spark ignition engine, the knock being most pronounced at low humidities. In order to eliminate this effect in knock-rating tests, a system has been established by which the fuel of unknown characteristics is bracketed between two blends of reference fuels differing only slightly in their knocking tendencies. It has been found that if both the reference and the test fuels are of the same type, the effect of atmospheric variations on the knock ratings can be eliminated by this means. However, even with this bracketing method variations in the results from the same fuel, obtained by different laboratories and even in the same laboratory at different times, continued to attract attention; they seemed to be most pronounced when fuels of widely different characteristics were being rated, and indicated the influence of some atmospheric variable on the combustion of the fuel. This suggested that variations in the water vapor present in atmospheric air might be acting differently with different fuels. An investigation covering the range of atmospheric humidity in twenty engine testing laboratories throughout the U. S. in the course of the year and the effect of changes in atmospheric humidity on knock ratings by the bracketing method, was dealt with in a paper by J. R. MacGregor of Standard Oil Co. of California. The influence of humidity on the detonation of typical fuels is shown in the diagram herewith.

In the paper the apparatus for determining and controlling atmospheric humidity is described and illustrated. A standard humidity of 0.0135 lb. of water vapor per pound of dry air has been adopted by the Richmond laboratory of the Standard Oil Co. of California. This is believed to have been the approximate atmospheric humidity in the laboratory in which, and during the time of the year during which the C.F.R. Motor Method was originally established. Mr. MacGregor's conclusions from the experimental work done were as follows:

"For refinery control it is possible that for some normal gasolines bracketed with straight run reference fuels, providing the same are calibrated under standard humidity conditions, no great error will result with the humidity varying over the normal range. However, with the increase in use of special type fuels, for reference fuel calibration, and especially for fuels containing tetraethyl lead, some form of humidity control is required. The exact humidity to be used as standard has not yet been determined, but satisfactory reasons appear for choosing 0.0135 pound of water per pound of dry air and its adoption as standard in all knock rating tests is hereby suggested."

Coach sans Chassis

THE chassis-less coach was the subject of a paper by Stanley E. Knauss of the Motor-Coach Division of Gar Wood Industries, with special reference to a coach designed by Wm. B. Stout and produced by Gar Wood Industries under license. This coach has a body of the self-supporting type and is without chassis frame. Steel tubing is used for the body framework. It was decided early that the engine was to be placed elsewhere than in front and that a special suspension was to be used for the sake of passenger comfort. The experimental model, seating 24 passengers, weighed less than 6500 lb. After extensive experience with the experimental model in the hands of various operators, the coach last spring was redesigned to facilitate its production.

Most of the material in the framework is 1¼-in. square welded tubing. Some round tubing is used at the

front and rear ends, where double curves appear, to facilitate the installation of the outside metal covering. All frame joints are welded. The outside metal covering (sides, roof, bottom) is of 22-gage body sheets and is installed with self-threading screws, which is said to make the replacement of a damaged panel an easy job. The frame unit complete weighs 745 lb., without doors, the steel and aluminum covering approximately 750 lb. Another 750 lb. is required for the plywood floor, linoleum, inside walls, head lining, molding, and insulating material.

Owing to the lightness of the coach it is possible to use small mass-production powerplants and axles, which has a number of advantages, including high gasoline economy, and the availability of replacement parts in every city in the country, making it unnecessary for bus operators to maintain their own stock room. Another advantage is the use of smaller tires, which are lower in cost and bring the coach closer to the ground. While the production of a welded tubular frame of this type would have presented serious production problems ten years ago, improvements in welding technique during the past several years are claimed to have fully solved these.

Experience with a fleet of these coaches in actual service is said to have shown that more than 60,000 miles can be obtained from a set of 6.50/20 tires, and more than 40,000 miles from brake linings. Gasoline consumption is said to be less than half that of heavier coaches of the same capacity, and drivers are less subject to fatigue. Two major accidents which have occurred to these buses in the hands of operators are said to show that the tubular framework meets all safety requirements.

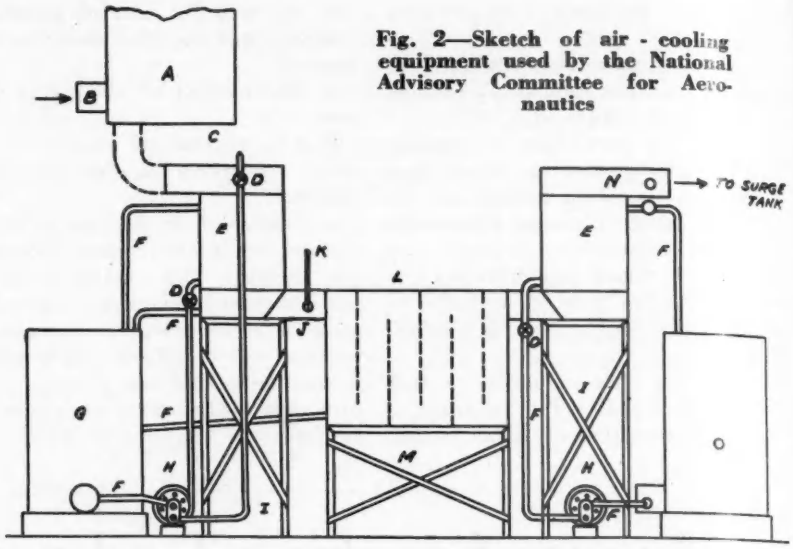


Fig. 2—Sketch of air - cooling equipment used by the National Advisory Committee for Aeronautics

New Equipment for Altitude Tests

THE effect of altitude on the limiting output of Diesel engines is of considerable importance in connection with aircraft applications, and an investigation of this subject made for the National Advisory Committee for Aeronautics was dealt with in a paper by Charles S. Moore and John H. Collins, Jr. of the N.A.C.A. laboratory staff. The experimental work was carried out on a single-cylinder four-stroke 5 by 7-in. engine with a compression ratio of 14.5 and running at 2,000 r.p.m. Automobile Diesel fuel was used, of 0.847 spec. gr., 41 sec. Saybolt Universal viscosity at 80 deg. F., and 66 cetane number. It was injected by the N. A. C. A. constant-stroke injection pump through an N.A.C.A. automatic spring-loaded injection valve adjusted to 3,500 lb. per sq. in. injection pressure, the injection period being 25 deg. of crank angle and the injection quantity 0.000356 lb. per cycle.

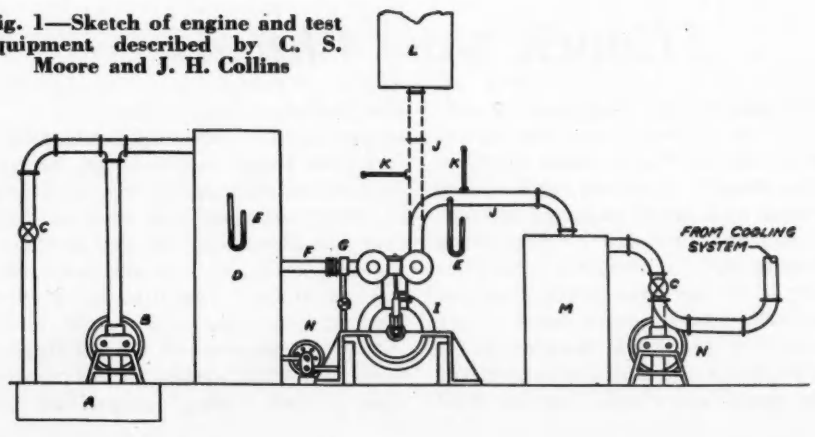


Fig. 1—Sketch of engine and test equipment described by C. S. Moore and J. H. Collins

For very exact altitude tests an altitude chamber like that at the National Bureau of Standards should be used, but it has been proved that reliable results can be obtained by considerably simpler equipment, and such was used in these tests. A diagrammatic representation of the test apparatus is shown in Fig. 1. By means of gate valve in the air line to the inlet surge tank, any reduction in inlet pressure could be maintained at the engine inlet, the pressure being indicated by a mercury gage connected at a point about 18 in. from the intake port. The Roots blower connected to the exhaust tank was used to evacuate the tank to correspond to the pressure of the altitude that was being simulated.

The chief difficulty in making altitude tests is, of course, the problem of reproducing the corresponding air temperature. For these tests the air-cooling apparatus shown in Fig. 2 was designed and built. Because of the necessity of taking care of the moisture as it was condensed out of the air, the cooling of the air was divided into two stages. In the first stage a 50-50 solution of Prestone and water was used as the coolant. The 50-gal. tank of the coolant was directly charged with solid CO_2 until the temperature was reduced to approximately—20 deg. Fahr. The rate of charging was controlled to hold this temperature during the operation of the system.

In the second stage kerosene was used as the coolant, because the temperature could be lowered without a decided in-

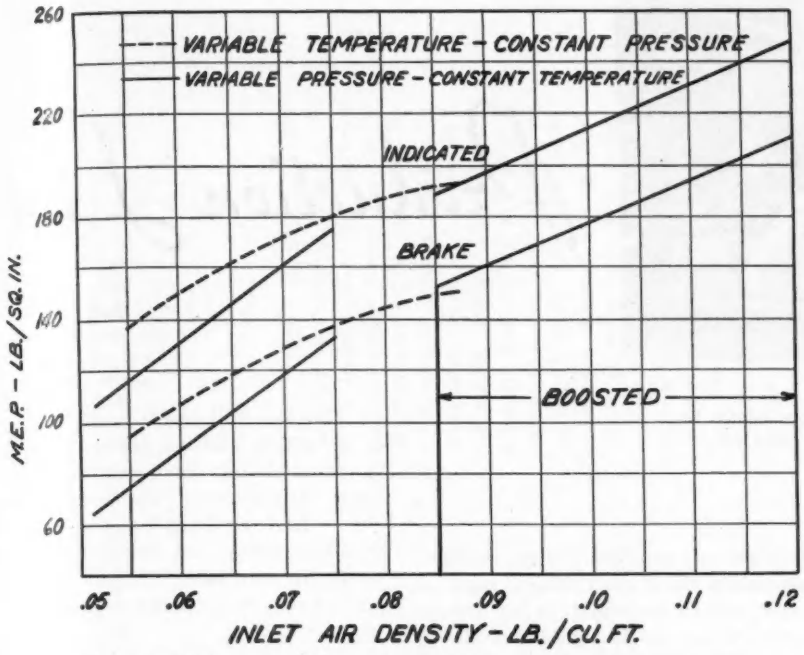


Fig. 3—Effect of inlet-air temperature on maximum performance at sea level shown by C. S. Moore and J. H. Collins

crease in viscosity. Cakes of solid CO_2 were placed into the 50-gal. kerosene tank and the temperature was maintained at −35 to −40 deg. Fahr.

Inlet air for the engine was brought into the first-stage cooler for dehumidifying and cooling. This cooler consisted of a radiator having 60.88 sq. ft. of cooling area with 27.72 sq. in. of area for the air flow. The rate of flow for the engine operating speed of 2,000 r.p.m. was approximately 70 cu. ft. per min. at sea-level pressure. Circulation of the cold Prestone-water solution through the tubes of the radiator cooled the first-stage cooler. A secondary deicing circulation was maintained by spraying the outside of the tubes with the same solution. This second circuit is called "defrosting" spray and was necessary to prevent the radiator from becoming clogged with ice. The air and defrosting spray passed on to the snow box where the entrained solution, which had taken up the moisture from the air, was settled out. At a temperature of about −5 deg. Fahr. the cold dry air went to two kerosene coolers in parallel arrangement, where it was further cooled to −30 deg. Fahr.

From the cooling system the air was throttled into the inlet surge tank at a pressure corresponding to the air temperature for a standard altitude. The exhaust pressure was also lowered, and an altitude test was made.

Some values derived from results of these tests are plotted in Figs. 3 and 4.

The tests described in the paper are said to indicate that—

1. The altitude performance of both a supercharged and an unsupercharged compression-ignition engine would compare advantageously with a carburetor engine; the low temperatures of altitude are especially important in maintaining the altitude power of the compression-ignition engine.

2. Maximum performance of this unsupercharged compression-ignition engine cannot be accurately corrected on an inlet-air density or weight of air charge basis for differences of inlet-air temperature and pressure.

3. Maximum unsupercharged performance can be corrected, when maximum cylinder pressure does not limit output, as follows:

For each inch of Hg increase in inlet-air pressure add 7.4 lb. per sq. in. indicated or brake mean effective pressure.

For each deg. Fahr. increase in inlet-air temperature subtract 0.226 lb. per sq. in. indicated or brake mean effective pressure.

4. Maximum boosted performance with conservative maximum cylinder pressures can be corrected as follows:

For each inch of Hg increase in inlet-air pressure add 4.0 lb. per sq. in. indicated or brake mean effective pressure.

5. Reduced exhaust back pressure increased engine power slightly while increased exhaust back pressure decreased engine power at an increasing rate.

Engine Friction Tests

ENGINE friction is generally determined by the "motoring" method, the engine being driven by the dynamometer at the speed for which it is desired to ascertain the friction, and the dynamometer torque measured. It is generally recognized that this test, which is practical and convenient, cannot give the friction under load conditions very accurately, and some experimental work carried out at M.I.T., with the object of determining the degree of error in the motoring test and, if possible, establishing a correlation between it and the true engine friction, was dealt with in a paper by Milton K. McLeod.

The procedure was to run the engine under the operating conditions desired and to take indicator diagrams simultaneously with brake-load and speed measurements. The M.I.T. point-by-point indicator was used in these tests. It is of the balanced-diaphragm type and gives an average card over a number of cycles. By means of a mechanical device, diagrams were changed to the P-V plane and the indicated mean effective pressure measured by a planimeter. The difference between the i.m.e.p. as determined from the card and the b.m.e.p. as measured by the brake, is a measure of the friction m.e.p. The accuracy of the indicator method of measuring friction is dependent on measurements of the b.m.e.p. and the i.m.e.p. In general practice, by the use of the beam balance, the b.m.e.p.

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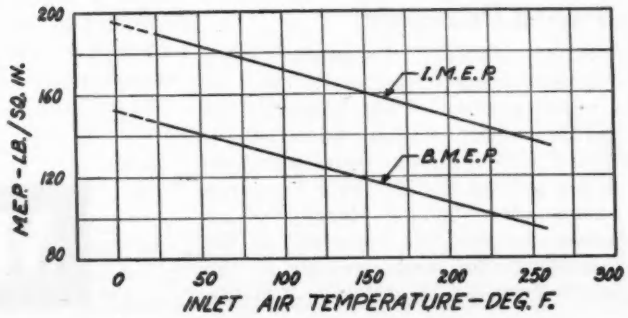

Fig. 4—Effect of inlet-air density on maximum M.E.P. at sea level

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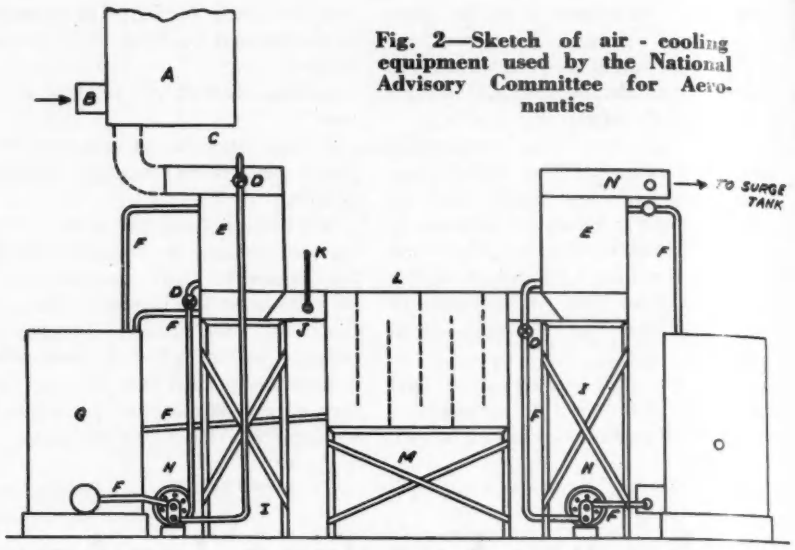


Fig. 2—Sketch of air - cooling equipment used by the National Advisory Committee for Aeronautics

New Equipment for Altitude Tests

THE effect of altitude on the limiting output of Diesel engines is of considerable importance in connection with aircraft applications, and an investigation of this subject made for the National Advisory Committee for Aeronautics was dealt with in a paper by Charles S. Moore and John H. Collins, Jr. of the N.A.C.A. laboratory staff. The experimental work was carried out on a single-cylinder four-stroke 5 by 7-in. engine with a compression ratio of 14.5 and running at 2,000 r.p.m. Automobile Diesel fuel was used, of 0.847 spec. gr., 41 sec. Saybolt Universal viscosity at 80 deg. F., and 66 cetane number. It was injected by the N. A. C. A. constant-stroke injection pump through an N.A.C.A. automatic spring-loaded injection valve adjusted to 3,500 lb. per sq. in. injection pressure, the injection period being 25 deg. of crank angle and the injection quantity 0.000356 lb. per cycle.

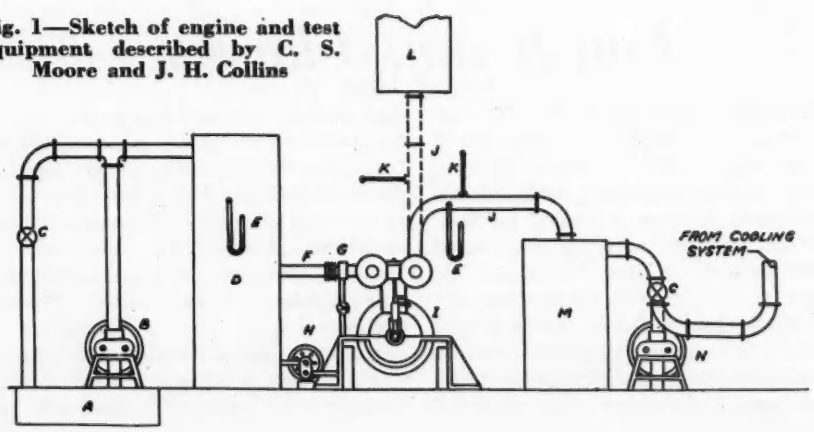


Fig. 1—Sketch of engine and test equipment described by C. S. Moore and J. H. Collins

For very exact altitude tests an altitude chamber like that at the National Bureau of Standards should be used, but it has been proved that reliable results can be obtained by considerably simpler equipment, and such was used in these tests. A diagrammatic representation of the test apparatus is shown in Fig. 1. By means of gate valve in the air line to the inlet surge tank, any reduction in inlet pressure could be maintained at the engine inlet, the pressure being indicated by a mercury gage connected at a point about 18 in. from the intake port. The Roots blower connected to the exhaust tank was used to evacuate the tank to correspond to the pressure of the altitude that was being simulated.

The chief difficulty in making altitude tests is, of course, the problem of reproducing the corresponding air temperature. For these tests the air-cooling apparatus shown in Fig. 2 was designed and built. Because of the necessity of taking care of the moisture as it was condensed out of the air, the cooling of the air was divided into two stages. In the first stage a 50-50 solution of Prestone and water was used as the coolant. The 50-gal. tank of the coolant was directly charged with solid CO_2 until the temperature was reduced to approximately—20 deg. Fahr. The rate of charging was controlled to hold this temperature during the operation of the system.

In the second stage kerosene was used as the coolant, because the temperature could be lowered without a decided in-

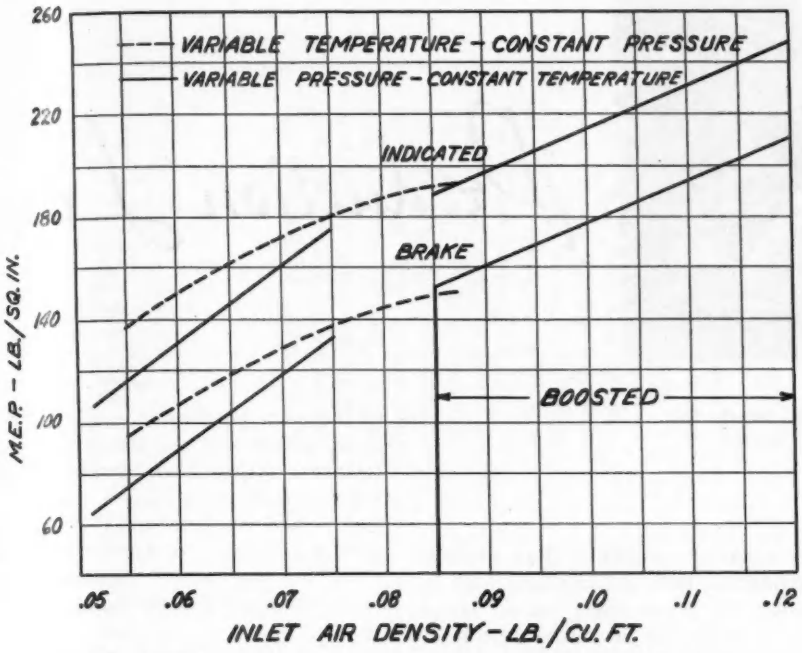


Fig. 3—Effect of inlet-air temperature on maximum performance at sea level shown by C. S. Moore and J. H. Collins

crease in viscosity. Cakes of solid CO_2 were placed into the 50-gal. kerosene tank and the temperature was maintained at −35 to −40 deg. Fahr.

Inlet air for the engine was brought into the first-stage cooler for dehumidifying and cooling. This cooler consisted of a radiator having 60.88 sq. ft. of cooling area with 27.72 sq. in. of area for the air flow. The rate of flow for the engine operating speed of 2,000 r.p.m. was approximately 70 cu. ft. per min. at sea-level pressure. Circulation of the cold Prestone-water solution through the tubes of the radiator cooled the first-stage cooler. A secondary deicing circulation was maintained by spraying the outside of the tubes with the same solution. This second circuit is called "defrosting" spray and was necessary to prevent the radiator from becoming clogged with ice. The air and defrosting spray passed on to the snow box where the entrained solution, which had taken up the moisture from the air, was settled out. At a temperature of about −5 deg. Fahr. the cold dry air went to two kerosene coolers in parallel arrangement, where it was further cooled to −30 deg. Fahr.

From the cooling system the air was throttled into the inlet surge tank at a pressure corresponding to the air temperature for a standard altitude. The exhaust pressure was also lowered, and an altitude test was made.

Some values derived from results of these tests are plotted in Figs. 3 and 4.

The tests described in the paper are said to indicate that—

1. The altitude performance of both a supercharged and an unsupercharged compression-ignition engine would compare advantageously with a carburetor engine; the low temperatures of altitude are especially important in maintaining the altitude power of the compression-ignition engine.

2. Maximum performance of this unsupercharged compression-ignition engine cannot be accurately corrected on an inlet-air density or weight of air charge basis for differences of inlet-air temperature and pressure.

3. Maximum unsupercharged performance can be corrected, when maximum cylinder pressure does not limit output, as follows:

For each inch of Hg increase in inlet-air pressure add 7.4 lb. per sq. in. indicated or brake mean effective pressure.

For each deg. Fahr. increase in inlet-air temperature subtract 0.226 lb. per sq. in. indicated or brake mean effective pressure.

4. Maximum boosted performance with conservative maximum cylinder pressures can be corrected as follows:

For each inch of Hg increase in inlet-air pressure add 4.0 lb. per sq. in. indicated or brake mean effective pressure.

5. Reduced exhaust back pressure increased engine power slightly while increased exhaust back pressure decreased engine power at an increasing rate.

Engine Friction Tests

ENGINE friction is generally determined by the "motoring" method, the engine being driven by the dynamometer at the speed for which it is desired to ascertain the friction, and the dynamometer torque measured. It is generally recognized that this test, which is practical and convenient, cannot give the friction under load conditions very accurately, and some experimental work carried out at M.I.T., with the object of determining the degree of error in the motoring test and, if possible, establishing a correlation between it and the true engine friction, was dealt with in a paper by Milton K. McLeod.

The procedure was to run the engine under the operating conditions desired and to take indicator diagrams simultaneously with brake-load and speed measurements. The M.I.T. point-by-point indicator was used in these tests. It is of the balanced-diaphragm type and gives an average card over a number of cycles. By means of a mechanical device, diagrams were changed to the P-V plane and the indicated mean effective pressure measured by a planimeter. The difference between the i.m.e.p. as determined from the card and the b.m.e.p. as measured by the brake, is a measure of the friction m.e.p. The accuracy of the indicator method of measuring friction is dependent on measurements of the b.m.e.p. and the i.m.e.p. In general practice, by the use of the beam balance, the b.m.e.p.

(Turn to page 97, please)

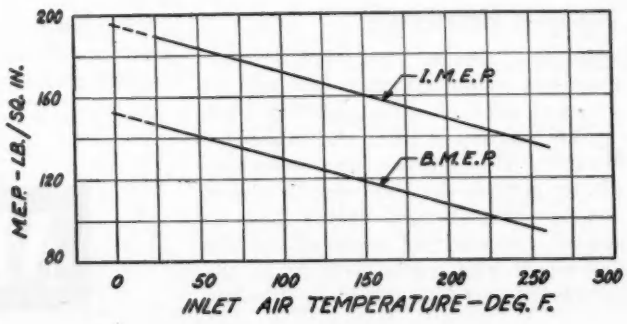


Fig. 4—Effect of inlet-air density on maximum M.E.P. at sea level

Production Lines

Lincoln Zephyr V-12's coming off the line ready for inspection before being sent into service

Standard Tips

No one in the automotive industry has to be sold on the idea of the economic benefits of standardization. Untold millions of dollars have been saved through standardization of steels and fastenings alone. So our attention was attracted immediately when we were shown another project which holds considerable promise. This concerns the familiar welding tips used on gun welders. It is only in recent years that gun welders have become a very large factor in production and in the interim there has grown a wide variety of tip sizes and forms. In all probability these tips could stand some standardization, at least to the extent of reducing the number of wanted sizes and forms. When you consider that such tips are forged and require forging dies as well as special fixtures for machining, the possibility of reduced cost becomes quite attractive. When this project is broached some time in the very near future, we believe that welding executives will receive it sympathetically.

New Buildings

Just this season we have noted a very important activity in new plant construction utilizing the best known principles current in the automotive industry. Examples of such construction are—the Grand Rapids Stamping Division of G. M., the new DeSoto plant, Chrysler's Airtemp Division in Dayton, and the Chevrolet commercial body plant in Indianapolis. During the course of our recent visit to Indianapolis we saw another plant that will break the news soon. It's the new machine shop building of P. R. Mallory. This is a modern single-story structure of some 41,000 sq. ft. of floor space with about 80 per cent of its wall and ceiling area in glass so as to afford the maximum of daylight. For artificial illumination they use the new high intensity G. E. mercury vapor lamps. Machinery layout is made flexible by the use of overhead power ducts which may be plugged in at any point so that machines may be shifted at will any time.

Tick-Tock

Several years ago we had occasion to discuss the work being done by automotive manufacturers by way of reducing the noise level in motor cars. Since then, much constructive work has been accomplished and today most cars are so well treated acoustically that noise is almost a thing of the past. However, the reduction of noise level of the major elements of the car has uncovered little things of no consequence ordinarily because they have been masked by the more important sounds and noises. This was brought to our attention most forcibly by the major executive of a fine car company who was concerned over the fact that some of his customers were complaining that they were disturbed by the ticking of the clock. We took a ride in one of the cars and found that the sound of the clock indeed was audible when you listened for it. So now the big problem is to still the tick-tock.

Detroit Principle

Harry Moock, Plymouth sales-manager, made a mighty fine talk at a recent meeting of the Adcraft Club, on the subject—"After Advertising—What?" His answer was—merchandizing, getting the idea over to people. Among other things, Harry had an answer for the "old reporter" of the Satevepost who wrote recently on the Detroit Principle. Said Harry—"So long as there are millions of people who ache to go places and see things, and want to travel sitting down—so long do they want automobiles above everything else. And as long as this situation persists, there can be no saturation point for car sales." Which hits the nail pretty well on the head.

Protect Grilles

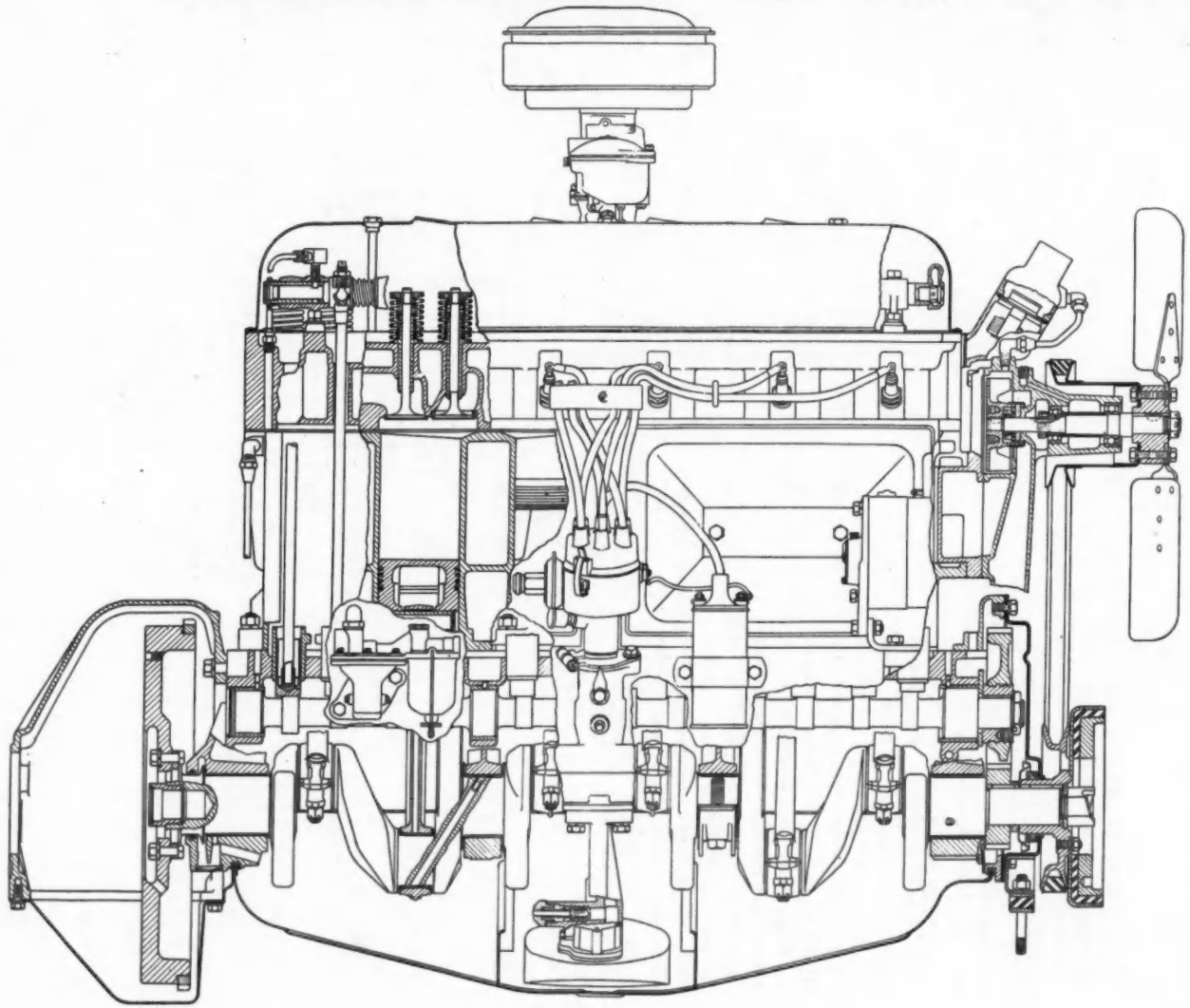
Those new grilles that set off the front end of today's cars are giving their owners no end of concern, at least around Detroit where men are men and bumpers are used to push a street-full of cars. Around these parts we note the appearance of special bumper guards not only for the sides but also in the center to protect the grille. In fact we saw a taxicab several days ago that had a separate bumper bar set about 12 in. above the main bumper in front. Evidently the time is ripe to consider the standardization of bumper heights on all manner of vehicles including motor trucks.

By Single-Point

One of the parts makers has developed a real novelty in machining practice. For boring malleable castings, they have developed a new precision boring set-up using a single-point Carboloy tool, and this set-up finishes the hole in one pass from the rough. While this has not been done before on the particular type of equipment, it seems to be a perfectly sound way of doing certain jobs. Their experience with this machine should be of great interest to factory men. —J. G.

MANUFACTURING MANAGEMENT METALLURGY

General Motors No. 239 Truck Engine

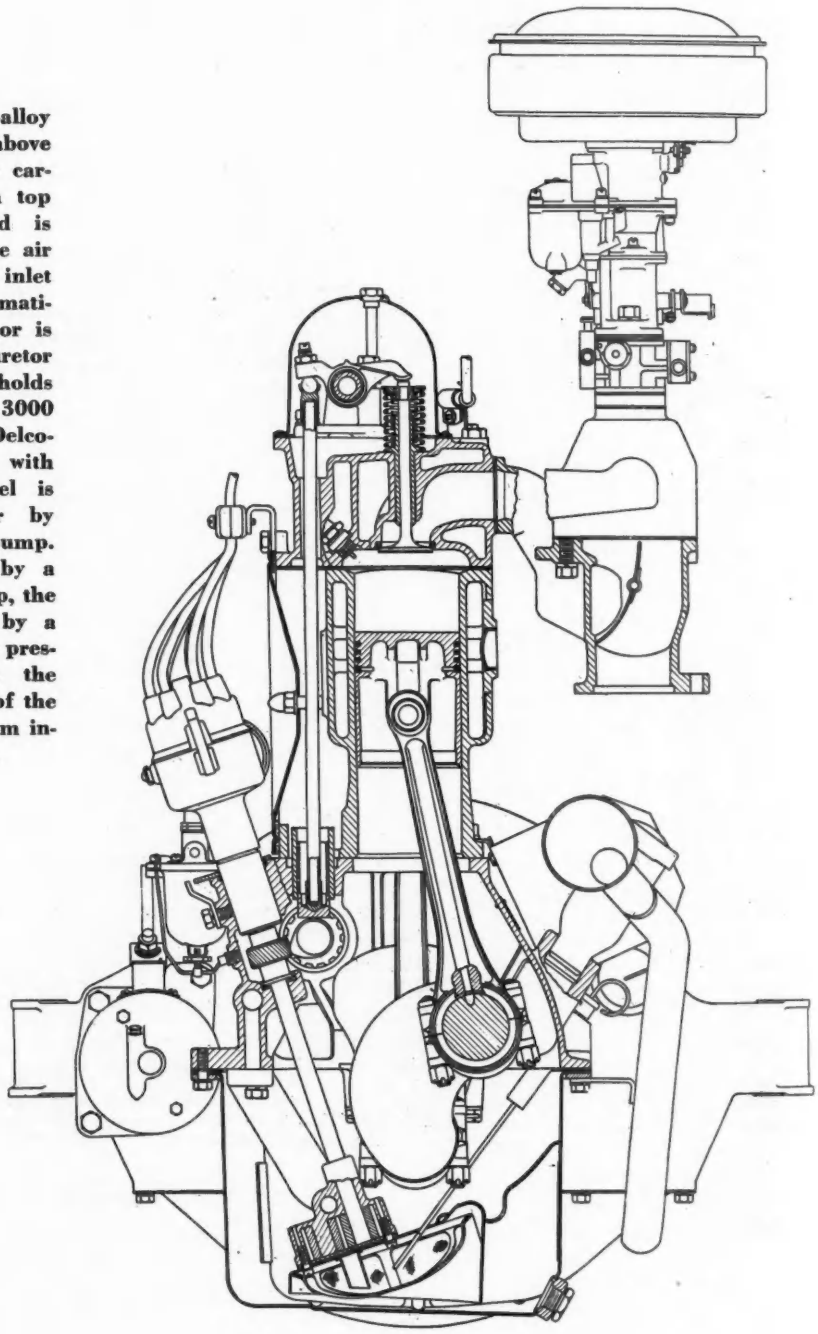


G.M.C. "239" engine is a six-cylinder valve-in-head engine of 3 5/16-in. bore by 4⅝-in. stroke, which makes its piston displacement 239 cu. in. Its compression ratio is 5.1:1, its maximum torque, 170 lb-ft., and its output rating, 81 hp. at 3000 r.p.m. The valves are located in the cylinder head and are actuated from the camshaft in the crankcase through the intermediary of side rods and rocker levers. Exhaust valves are seated on valve-seat inserts. The crankshaft has four bearings of 2⅜-in. diameter and an aggregate length of 7 23/32 in. End thrust is taken up on the third bearing from the front. Connecting-rod bearings are 2⅛ in. in diameter and 1½ in. long. The connecting rod has a center-to-center length of 10 in. Pressure lubrication is carried through the drilled connecting rods to the piston pin bearings.

No. 9 in the AUTOMOTIVE INDUSTRIES Series of Engineering Drawings

GM Model 239 Truck Engine

This engine has aluminum-alloy pistons with four rings, all above the piston pin. A downdraft carburetor is used, mounted on top of the inlet manifold, and is equipped with an oil-bath-type air cleaner. Heat supply to the inlet manifold is controlled automatically. A velocity-type governor is interposed between the carburetor and the inlet manifold and holds the engine speed down to 3000 r.p.m. Ignition is by the Delco-Remy 6-volt battery system, with full-automatic advance. Fuel is supplied to the carburetor by means of an A.C. diaphragm pump. Cooling water is circulated by a centrifugal packless-type pump, the circulation being controlled by a thermostat. Lubrication is by pressure throughout, including the valve rocker bearings on top of the engine. The lubricating system includes an A.C. oil filter.



STARTING MOTORS AND BATTERIES

Line Number	CAR MAKE AND MODEL	STARTING MOTOR: Make	Model	Cranking Speed	Lock Test: Amperage Draw	Lock Test: Volts	Lock Test: Torque (Ft. Lbs.)	No Load Test: Amperage Draw	No Load Test: Volts	No Load Test: R.P.M.	Drive—Type	Automatic Starter: Make	Automatic Starter: Type	Pinion Meshes	FLYWHEEL: No. of Teeth	FLYWHEEL: Face Width of Teeth	FLYWHEEL: Teeth Integral	FLYWHEEL: Ratio to Starter	BATTERY: Make	Capacity-Amp. Hrs. at 20 M.P.H.	Plates per Cell	Bench Charging Rate: Start	Bench Charging Rate: Finish	Terminal Grounded	Line Number
1	American Bantam	AL									Ben	No	No												1
2	Auburn 654	AL	MAB-4032	155	555	3.0	12.0	55			Ben	Star	PB	F	110	7/8	Int	11.00	USL	90	15	12.0	4.5	P	2
3	Auburn 852	AL	MAB-4063	140	582	3.0	15.5	60			Ben	Star	PB	F	110	7/8	Int	11.00	USL	105	15	14.0	5.2	P	3
4	Auburn SC-852	AL	MAB-4063	140	582	3.0	15.5	60			Ben	Star	PB	F	110	7/8	Int	11.00	USL	105	15	14.0	5.2	P	4
5	Buick Special 37-40	DR	734-Z	135	575	3.40	12.0	65	5.0	5000	SG-OC	DR	SA	F	146	11/64	SR	16.22	Del	100	13	7.0†	7.0	N	5
6	Buick Century 37-60	DR	727-W	115	600	3.00	16.0	65	5.0	5000	SG-OC	DR	SA	F	156	11/64	SR	17.33	Del	120	15	8.0†	8.0	N	6
7	Buick Roadmaster 37-80	DR	727-W	115	600	3.00	16.0	65	5.0	5000	SG-OC	DR	SA	F	156	11/64	SR	17.33	Del	120	15	8.0†	8.0	N	7
8	Buick Limited 37-90	DR	727-W	115	600	3.00	16.0	65	5.0	5000	SG-OC	DR	SA	F	156	11/64	SR	17.33	Del	120	15	8.0†	8.0	N	8
9	Cadillac V8-60	DR	727-V-4p		600	3.0	16.0	65	5.0	5500	SG		PB	F	156	1/2	SR	17.00	Del	110		10.0	8.0	P	9
10	Cadillac V8-65	DR	727-V-4p		600	3.0	16.0	65	5.0	5500	SG		PB	F	156	1/2	SR	17.00	Del	110		10.0	8.0	P	10
11	Cadillac V8-70	DR	727-V-4p		600	3.0	16.0	65	5.0	5500	SG		PB	F	156	1/2	SR	17.00	Del	130		10.0	8.0	P	11
12	Cadillac V8-75	DR	727-V-4p		600	3.0	16.0	65	5.0	5500	SG		PB	F	156	1/2	SR	17.00	Del	130		10.0	8.0	P	12
13	Cadillac V12-85	DR	580-6p		600	3.0	35.0	70	5.7	2200	SG		PB	F	156	1/2	SR	17.00	Del	160		10.0	8.0	P	13
14	Cadillac V16-90	DR	580-6p		600	3.0	35.0	70	5.7	2200	SG		PB	R	113	.622	SR	21.00	Del	190		10.0	8.0	N	14
15	Chevrolet Master	DR	739-A	65	525	3.2	14.0	125	5.4	2500	Ben	CD		F	139	1/2	SR	15.44	Del	100	17	6.0	5.0	N	15
16	Chevrolet Master De Luxe	DR	739-A	65	525	3.2	14.0	125	5.4	2500	Ben	CD		F	139	1/2	SR	15.44	Del	100	17	6.0	5.0	N	16
17	Chrysler Royal C-16	AL	MAW-4010								MG	No	No	F	146	1/2	SR	16.22	Wil	105	15			P	17
18	Chrysler Imperial C-14	AL	MAX-4003								MG	No	No	F	146	1/2	SR	16.22	Wil	119	15			P	18
19	Chrysler Custom Imperial C-15	AL	MAX-4003								PB	No	No	F	146	11/64	SR	16.22	Wil	136	17			P	19
20	Chrysler Airflow C-17	AL	MAX-4015								PB	No	No	F	146	11/64	SR	16.22	Wil	136	17			P	20
21	Cord Front Drive 812	AL	MAX-4021	130	680	4.0	25.0	65	5.5	5300	Ben	Ecl	Star	F	141	1/2	SR	15.66	USL	108	19			P	21
22	De Soto S-3	AL	MAW-4010								MG	No	No	F	146	1/2	SR	16.22	Wil	105	15			P	22
23	Dodge D-5	AL	MAW-4010								MG	No	No	F	146	1/2	SR	16.22	Wil	95	15			P	23
24	Duesenberg 8	DR	429		500	3.0	19.0	70	5.0	3000	Ben	No	No	R	119	11/64	SR	11.90	Exl	143		10.0	10.0	N	24
25	Ford V8-60																								25
26	Ford V8-85			100																100	17			P	26
27	Graham Crusader 85	DR	738V		475	3.6	12.0	65	5.0	5000	MG	No	No	F	130	1/2	SR	14.40	Wil	90	13			P	27
28	Graham Cavalier 95	DR	738T		475	3.6	12.0	65	5.0	5000	MG	No	No	F	130	1/2	SR	14.40	Wil	90	13			P	28
29	Graham Supercharger 116	DR	738T		475	3.6	12.0	65	5.0	5000	MG	No	No	F	130	1/2	SR	14.40	Wil	105	15			P	29
30	Graham Supercharger 120	DR	738T		475	3.6	12.0	65	5.0	5000	MG	No	No	F	130	1/2	SR	14.40	Wil	105	15			P	30
31	Hudson 73	AL	MAB-4075	150	780	4.0	22.5	60	5.5	2250	Ben	No	No	R	134	.406	SR	14.90	Nat	105	17			P	31
32	Hudson 74-5-6-7	AL	MAB-4075	150	780	4.0	22.5	60	5.5	2250	Ben	No	No	R	134	.406	SR	14.90	Nat	125	19			P	32
33	La Salle 37-50	DR	727-V-4p		600	3.0	16.0	65	5.0	5500	SG	DR	PB	F	156	1/2	SR	17.00	Del	110		10.0	8.0	P	33
34	Lincoln Zephyr V12			90				14				No	No	R	112	.375	SR	11.20		100	17			P	34
35	Lincoln																								35
36	Nash Lafayette 400-3710	AL	MAB-4076	160	167	5.0		50	6.0		Ben	No	No	R			SR	10.40	USL	100	13			P	36
37	Nash Ambassador 6-3720	AL	MAB-4076	160	167	5.0		50	6.0		Ben	Yes	CC	R			SR	10.40	USL	100	13			P	37
38	Nash Ambassador 8-3780	AL	MAB-4054	160	167	5.0		50	6.0		Ben	Yes	CC	R			SR	11.30	USL	116	15			P	38
39	Oldsmobile F-37	DR	739-G	100	475	3.6	12.0	65	5.0	5000	MG	No	No	F	145	1/2	SR	16.11	Del	94	15	12.5	4.5	N	39
40	Oldsmobile L-37	DR	729-J	100	600	3.0	15.0	60	5.0	6000	MG	No	No	F	145	1/2	SR	16.11	Del	110	17	12.5	5.25	N	40
41	Packard Six	DR	739-F		575	4.0	13	65	5.0	5000	Ben			F	140		SR	15.50	Wil	94	15			P	41
42	Packard 120-C	AL	MAX-4006		600	3.0	16	60	6.0	3750	Ben			F	140		SR	15.50	P-D	114	17			P	42
43	Packard Super Eight	DR	729-H		600	3.0	16	60	5.0	6000	Ben			F	148		SR	16.40	P-D	150	21			P	43
44	Packard Twelve	DR	664		610	2.9	26	70	5.0	3000	Ben			F	118		SR	11.80	P-D	150	21			P	44
45	Pierce-Arrow 1701	Dyn	DI-1314	102	700	3.8	25	165	5.4	1600	Ben	Star		F	116	3/4	SR	11.60	Wil	140	17			P	45
46	Pierce-Arrow 1702	Dyn	DI-1314	102	700	3.8	25	165	5.4	1600	Ben	Star		F	116	7/8	SR	11.60	Wil	160				P	46
47	Pierce-Arrow 1703	Dyn	DI-1314	102	700	3.8	25	165	5.4	1600	Ben	Star		F	116	1	SR	11.60	Wil	160				P	47
48	Plymouth P-3	AL	MAW-4009								MG	No	No	F	146	1/2	SR	16.22	Wil	90	13			P	48
49	Plymouth P-4	AL	MAW-4009								MG	No	No	F	146	1/2	SR	16.22	Wil	90	13			P	49
50	Pontiac De Luxe Six	DR	729E	53	600	3.0	16.0	65	5.0	5500	MG	No	No	F	139	1/2	SR	15.44	Del	94	15			N	50
51	Pontiac De Luxe Eight	DR	727-S	53	600	3.0	15.0	85	5.0	5500	MG	DR	Sol	F	139	1/2	SR	15.44	Del	107	17			P	51
52	Studebaker Dict. & Dict. Pf. 6	AL		110	640	3.2	16.0	60	5.6	5000	OC	No	No	F	130	1/2	SR	14.30	Wil	105	15	5¾	5¾	N	52
53	Studebaker President	DR	662-M	110	575	3.2	15.0	60	5.6	5000	OC	No	No	F	133	1/2	SR	14.78	Wil	105	15	5¾	5¾	N	53
54	Terraplane 71	AL	MAB-4075	150	780	4.0	22.5	60	5.5	2250	Ben	No	No	R	134	.406	SR	14.90	Nat	105	17			P	54
55	Terraplane 72	AL	MAB-4075	150	780	4.0	22.5	60	5.5	2250	Ben	No	No	R	134	.406	SR	14.90	Nat	105	17			P	55
56	Willys 37	AL	MZ-4049	216	540	4.0	12.25	70.0	5.5	4300	Ben	No	No	F	96	5/8	SR	9.6	USL	95	13	4½	4½	N	56

†—Or over
(a)—GCJ-4803A with Radio
4p—Four pole type
6p—Six pole type
AL—Autolite

Ben—Bendix
CC—Coincidental with clutch
CD—Chevrolet and Delco Remy
Del—Delco
Dyn—Owens-Dyneto

Ecl—Eclipse Machine Co.
Exl—Exide
F—Front
IL—Indicator Light
Int—Integral

MG—Manual Gear
N—Negative
Nat—National
OC—Overrunning Clutch
P—Positive

PB—Bush Button
P-D—Presto-Lite-Hi-Level or Delco
R—Rear
SA—Solonoid—accelerator control
SG—Solonoid operated Gear

Sh—Shaft
Sol—Solonoid
SR—Steel Ring
Star—Startix
Wil—Willard

New DEVELOPMENTS

Automotive Parts, Accessories and Production Tools

New Developments Received

Descriptions of the following new products will appear in forthcoming issues of AUTOMOTIVE INDUSTRIES, space permitting. If you desire immediate detailed information on this equipment, we suggest that you consult the manufacturer.

Pillow block, universal-type double reservoir oil return. Randall Graphite Products Corp., Chicago.

Straightening press, 75-ton. Hannifin Mfg. Co., Chicago.

Hydraulic press, high-speed portable. Hannifin Mfg. Co., Chicago.

Flow meters, new line of electric. Bristol Co., Waterbury, Conn.

Bolt heading and forging machine. The Ajax Mfg. Co., Euclid, Ohio.

Milling machine, vertical spindle. Brown & Sharpe Mfg. Co., Providence, R. I.

Auxiliary battery charging unit for commercial and house trailers. General Armature Corp., Chicago.

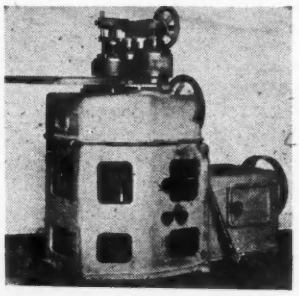
Automatic Feed

Machine To Straighten And Feed Coiled Stock To Punch Presses

A machine to straighten and feed coiled stock to double action presses which are either of the cam or toggle type has been announced by the F. J. Littell Machine Co., Chicago.

With the feeding unit illustrated, the operator manually trips the unit with his left hand. The strip is fed forward quickly, the press is tripped and the operator picks out the work-piece from the die. According to the manufacturers, by using this feeding and straightening outfit, an operator can increase production 50 to 100 per cent.

A power driven stock reel is used and the reel is equipped with an automatic shut-off to prevent the loop of material from getting too large. Either a cradle type or an automatic centering type of reel can be used, depending upon the weight of the coils.



Shatz angle bending machine

Angle Bending Rolls

Adjustable Schatz Machines Available in Various Sizes

"Schatz-Herkules" machines for rolling angles, tees, beams, channels, flats, etc., have been announced by the Schatz Mfg. Co., Poughkeepsie, N. Y. Various sizes are available for bending the smallest angle and up to 8 in. by 8 in. by 1 in. A unique feature of the equipment is that the rolls are adjustable for rolling the different profiles, eliminating the necessity of interchanging the rolls.

Respirator

New Unit Provides Protection From Fume Or Dust Hazards

Announcement has been made by the DeVilbiss Co., Toledo, Ohio, of the development of a new Hood respirator designed for use in occupations where there is a fume or dust hazard beyond the protection offered by the more common type of respirator. The new device covers the head and neck and provides protection where ventilation is inadequate or against materials present in the air harmful to eyes, ears, or respiratory organs.

The entire unit is composed of a light-weight headgear, air filter and air hose which is connected to the air line with a DeVilbiss quick detachable connection, and a light-weight sanitary flame proofed hood which is supported by the headgear.

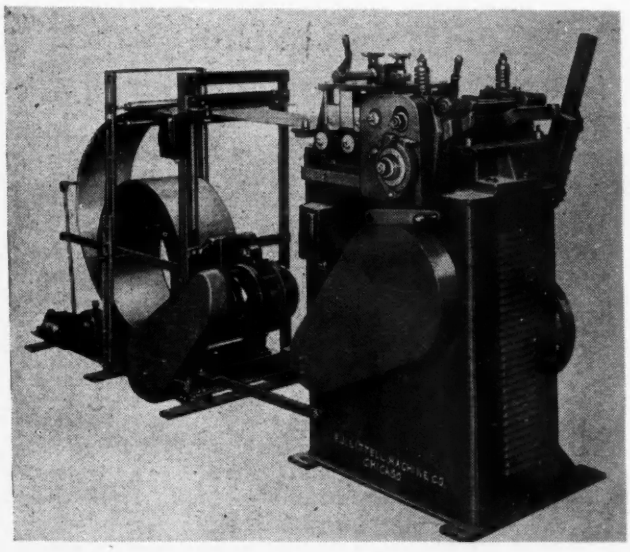
Conveyor Carrier

Truss-Frame Unit Built For Belts From 18 In. To 48 In. Wide

A "truss-frame," sealed ball bearing, belt conveyor carrier has been announced by Stephens-Adamson Mfg. Co., Aurora, Ill. This carrier, built in sizes for belts 18 in. to 48 in. wide, is of the three-roll in line design with outer rollers inclined to give the belt a 20 deg. trough. The whole roller assembly is tilted to center the belt without guide rollers.

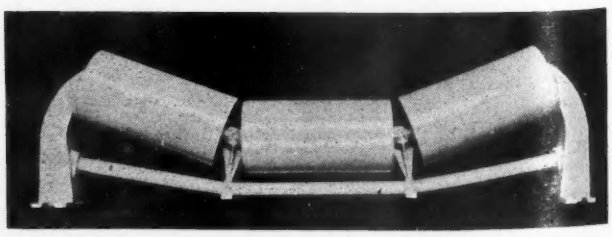
The rollers are built of five in. diameter steel tubing with ends rounded over the pressed steel and plates to prevent any tendency to fray the belt. Roller ends are recessed to house the bearings and allow rollers to be closely spaced to eliminate danger of pinching belts.

Renewable, cartridge-type ball-bearings are used throughout.



Left. Littell feeding unit

Below (right) Stephens-Adamson belt conveyor carrier



Engine Friction Tests

(Continued from page 91)

can be determined with an accuracy of about ½ per cent. In the determination of the i.m.e.p. the accuracy is also quite high. The average deviation of any single i.m.e.p. from the mean is about 1 per cent. A probable error of about 0.7 per cent can be expected from the average of five readings.

In the paper the test runs are described in detail and test results are given. Two conclusions are drawn, viz., that, since the difference in motoring friction and engine friction in normal operation depends on a large number of factors which vary with engine design and operating conditions, no good correlation between the two seems possible; and, second, that for routine friction tests the motoring method is more practical and convenient, but for accurate friction measurements and for studies with the object of reducing friction, the best method seems to be the use of an accurate indicator.

Car Design from the Insurance Angle

BEFORE any radical changes are made in body structures, their effect on the cost of repairs made necessary by collisions should be considered, according to Howard D. Brown, general attorney of the Detroit Inter-Insurance Exchange. If repair bills resulting from automobile accidents increase, so will the insurance rates, and the persons affected will have less money for something else. Mr. Brown said he was convinced the cost of making repairs from an insurance angle had increased 15 to 25 per cent during the past three years. This increased cost of repairs is not entirely due to an increase in the number of accidents. There are certain parts subject to injury on modern cars which earlier models did not have. For instance, a great deal of difficulty is encountered in repairing knee-action mechanisms and also the grille work on radiators. Grilles as now constructed are sometimes damaged in parking, and they cannot be easily repaired, so the insurance company must replace the entire grille.

Mr. Brown said insurance companies anticipated increased losses if the frameless construction, now under discussion, should gain vogue. However, only actual experience could tell what the effect on insurance rates would be. Another problem that would become more acute was that of prompt service to policyholders in case of accident. It is a question whether the type of body under discussion could be repaired in any shop without special machinery. If it cannot, the service problem will be very drastically affected. If an accident occurred in some remote region, it would mean the transportation of the damaged car to some metropolitan city where adequate service could be secured. This does not hold true today, as dealers throughout the United States are able to make reasonable repairs. The question of the length of loss of use of the car also comes in here.

Some apparently slight change in automobile construction often brings with it strange and unexpected results. For example, when the spare tire was put in the rear compartment, no one thought that it would have any effect whatever on insurance rates. What happened? Automobile tire thieves used a crowbar to open the rear deck in order to break the lock. They did this so effectively that they destroyed part

Forgings with a background—

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of the body construction. The insurance company, in order to pay for the spare tire and the attempted theft, had to repair that part of the body damaged, and this in many cases exceeded the entire cost of the spare tire.

The Urge for Streamlining

THE present trend toward "streamlining" automobiles was explained by Ralph H. Upson, aeronautical engineer, on the ground that aircraft have caught the popular fancy, but though he may have the psychological urge to fly, the average individual cannot buy an airplane and must be satisfied with an automobile dressed up like one. The appeal of streamlining is realized by car manufacturers and the job is turned over to an automobile stylist, bue the latter in most cases takes the semblance and lets the substance go. Although there may be some slight benefit from the smoother profile lines, the net gain is only a small fraction of what is readily possible. It seemed to be the author's opinion that present automobile styles cannot endure for long, because they lack proper balance and are not particularly suitable for their purpose. These two factors he regarded as the basis of the eye appeal of the modern airplane. There is a tendency to follow aircraft practice also in the matter of weight. Only a few years ago manufacturers and dealers were inclined to boast about the weights of their cars, but now the tendency is the other way around. Some of the specific possibilities for the reduction of drag and weight in automobiles were listed by the author as follows:

1. Improved streamlining of necessary exposed parts, particularly underneath; and incorporation of other accessories in the general body lines.
2. Use of curved glass in the windshield; lightening of all window material.
3. Reduction of the frame to the status of an assembly unit, with structural significance only in combination with the body.
4. More effective distribution of flange material around the doors.
5. Lightening of the skin by the use of internal stiffeners, particularly on top.
6. Development of a smaller, more efficient radiator; and lightening of various engine parts.

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Transmissions and Clutches for Buses

C. D. PETERSON of Spicer Mfg. Corp. talked on developments in transmissions and clutches for use with rear-mounted coach engines.

Many of the coach models brought out in recent years have the powerplant located under the rear seat which extends all the way across the body. Road experience with such coaches has shown that this location permits of a weight distribution that assures satisfactory control even under adverse conditions, and the driver's forward position gives him excellent vision. In one design the crankshaft is parallel with the axle but the transmission shafts are at right angles thereto. Two coach manufacturers use indirect-drive transmissions in connection with rear-mounted engines, one a direct-drive transmission. In one such coach the transmission is located directly above the axle, the axle having a vertical input shaft and the transmission a telescoping vertical output shaft.

In some of these coaches the transmissions are power-controlled. In one particular design referred to in the paper the Bendix-Westinghouse pneumatic gear-shifting system is used, and the clutch is also operated by the same system. Clutch and transmission control are interlocked and automatic in action, so that the clutch is fully disengaged before the speed change can be made, and a speed change must be

completed before the clutch can be engaged.

Some new problems in clutch design and application have arisen in connection with these installations, where the driver is at a considerable distance from the engine, so that he is less able to judge the speed of the engine by sound or feel. As a result the tendency is to start the vehicle with the engine running at somewhat higher speed, and also to let the engine speed up more when changing gear. This means that the clutch, whenever it is engaged, has to handle a somewhat greater speed differential, resulting in more heat generation and more rapid wear of the facings.

Various means have been resorted to with the object of countering this tendency toward reduced clutch life. Clutches of larger size or with clutch facings of special analysis, including metallic facings less subject to wear, are used. The pressure plate is made heavier to absorb the larger amount of heat produced. Pressure plates may be given a double heat treatment to reduce wear or to prevent "coning" due to varied wear at different diameters on the facing.

With these rear installations and drive through the rear wheels, the propeller shaft is naturally quite short, and if the conventional tubular shaft is used its high torsional rigidity results in greatly increased shock load on the drive members. Owing to its shortness, the propeller shaft need not be made tubular, and the desired torsional cushioning effect can be obtained by using a solid propeller shaft with a long, polished, reduced section. This same feature is provided in the "quill" type of transmission in which a "quill" shaft extending through the hollow primary shaft transmits power from the engine to the friction clutch at the far end of the transmission, this "through" shaft being reduced in diameter and polished over a considerable portion of its length. The torsional flexibility thus introduced in the drive is said to greatly lessen the transmission of noise due to engine torsional vibration.

Trailer Makers Ask for Uniform Laws

(Continued from page 70)

9. That all trailers shall be equipped with at least one adequate fire extinguisher of a type approved by Underwriters' Laboratories.
10. That all hitches shall be of approved type and that the pull car and trailer be further coupled together with a chain.
11. That all trailers in operation on highways be required to carry not less than three flares for emergency use when stopped on the highways after dark.
12. That all states accept full and complete reciprocity to all other states insofar as interstate movement of the trailer coach is concerned, and in the enactment and administration of just, equitable and uniform regulations to permit freedom of travel.

Carl W. Schelm, head of Schelbro Coach Co., of Peoria, Ill., president of the association, expresses his belief that all interests, public as well as private, will benefit from uniform legislation.

Motorcycle Sales in U. S. Broke All Records Last Year

Domestic sales of motorcycles in 1936 were the greatest in the history of the industry and were 31 per cent above those of the preceding year, it was announced during the annual convention of the Motorcycle and Allied Trades Association in New York last week. The association voted to cooperate fully with the American Motorcycle Association and the National Safety Council in an immediate nation-wide safety campaign, and to encourage a greater use of motorcycle traffic police officers throughout the country.

James A. Wright, sales manager of Indian Motorcycle Co., Springfield, Mass., was reelected president for his tenth term and E. C. Smith, Columbus, Ohio, became secretary for his ninth term. Other officers elected were: Frank J. Weschler, Baldwin-Duckworth Chain Co., Springfield, Mass., vice-president, and Arthur Davidson, Harley-Davidson Motorcycle Co., Milwaukee, Wis., treasurer.

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114 SB is typical of the many Durez compounds developed for specific requirements, and being widely used by molders of automotive parts. Better arc- and fatigue-resistance, better moisture resistance, better friction-resistance, faster molding—all these qualities can be obtained in Durez molding materials.

That's why Durez is the most widely-used thermosetting plastic in the automotive industry. General Plastics, Inc., 21 Walck Road, North Tonawanda, N. Y.

General Plastics'
DUREZ *Choice of the Automotive Industry*

Boat Show Great Success

(*Continued from page 71*)

Both models are equipped with reverse and reduction gears.

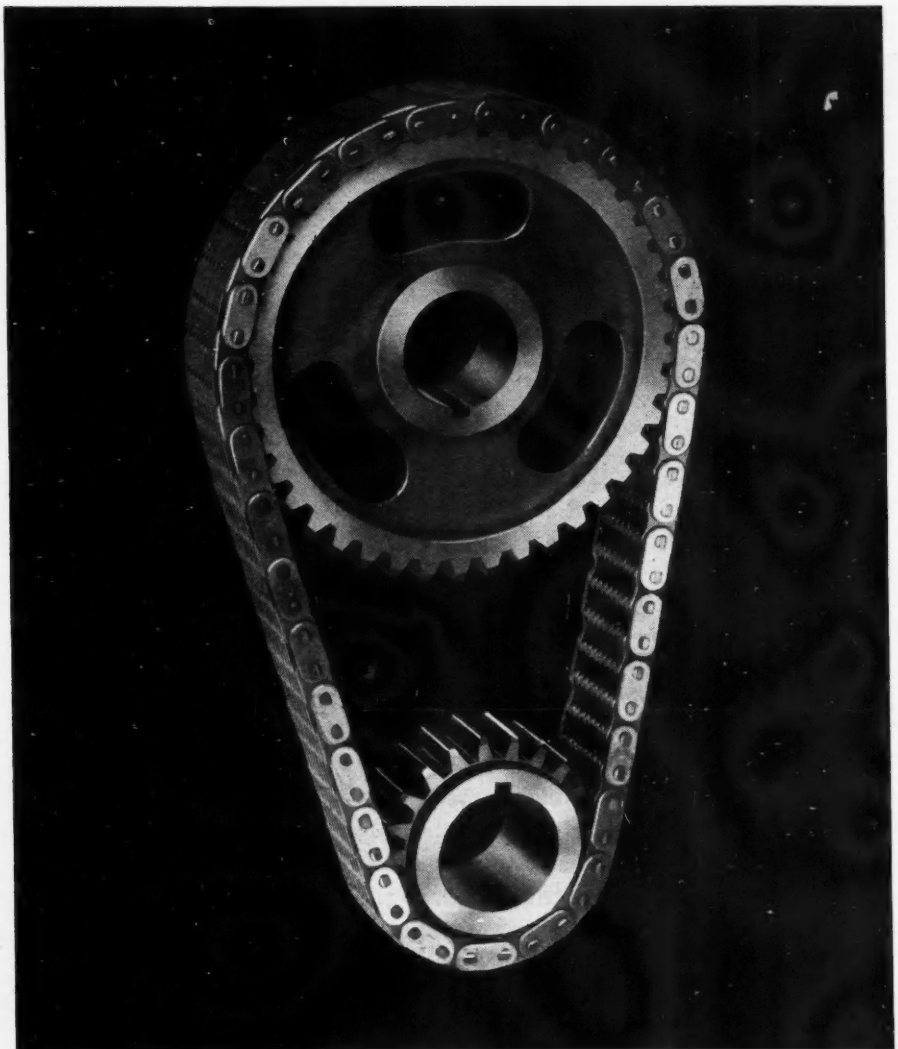
Among the new Diesel models brought out this year by the Cummins Engine Co., Columbus, Ind., is a 4-cyl. engine with a bore of 3¾ in. and a stroke of 5 in. It is rated at from 25 to 45 hp. at speeds ranging from 900 to 1800 r.p.m. The company also displayed a 6-cyl. unit, an adaptation of the larger models and redesigned for use in smaller boats. It has a 3¾ in. bore and 5 in. stroke, and develops 85 hp. at 2200 r.p.m.

The Hall-Scott Motor Co., Detroit, showed a new 4-cycle, 120 hp. Diesel engine with 5 in. bore and 6 in. stroke. The engine was mounted for display in a sectional boat and equipped with a 3 to 1 reduction gear. The demonstrator was also equipped with a fresh water cooling system which is standard equipment on all Hall-Scott Diesels.

Two gasoline marine engines, the Sea Prince and the Sea Zephyr, have been added to the line manufactured by the Kermath Mfg. Co., Detroit. The Sea Prince is a 6-cyl. unit with a bore of 3⅜ in. and a stroke of 4⅛ in. The piston displacement is 221 cu. in., and the rated horsepower of the engine is 90. The Sea Zephyr model is a marine adaptation of the Lincoln-Zephyr 12-cyl. engine. Bore and stroke dimensions are 2¾ in. and 3¾ in. respectively. It has a nominal rating of 110 hp., and maximum power is developed at 3800 r.p.m. A new Diesel marine engine was also shown by Kermath. This unit has a piston displacement of 298 cu. in. and bore and stroke dimensions of 3¾ in. and 4½ in. respectively. The engine develops 84 hp. at 2600 r.p.m.

The display of the Lycoming Mfg. Co., Williamsport, Pa., included a new 4-cyl. engine which develops 58 hp. at 3400 r.p.m. Piston displacement of this engine is 134 cu. in.

Palmer Bros. Engine, Inc., Cos Cob, Conn., introduced a new 4-cyl. gasoline marine engine which is rated at 60 hp. This model has a bore of 5½ in. and a stroke of 7 in.



Examine the features; compare the cost; then you will understand why most engineers exercise a preference for timing chains; and why their selection is—

MORSE SILENT TIMING CHAINS

Detroit, Michigan **Morse Chain Company** Ithaca, New York

Division Borg-Warner Corporation

Half-Million in December

(*Continued from page 69*)

would have topped even the seasonal peak of 1936 when, in April, production went to 527,726 units.

GM had set a January schedule of 224,000 units and together the "big three" had planned to turn out approximately 475,000 vehicles this month. These companies in December accounted for roughly 90 per cent of the industry's total output, and on this basis the industry would have built upwards of 527,000 vehicles this month if GM had escaped interference from organized labor.

As it is, GM closed the week with only six assembly lines in operation, of which five were Chevrolet plants and one the Los Angeles plant which builds Buick, Olds and Pontiac cars. These are expected to run short of materials before the end of next week, bringing the entire U. S. production of GM to a halt and dropping approximately 11,500 units from the industry's daily output.

How little the automobile manufacturers were affected by strikes of suppliers last month is reflected in their December production which turned out to be higher than even the most optimistic forecasts had indicated. On the basis of the AMA report showing December production of members at 389,382 units, it is now estimated that the industry as a whole last month turned out upwards of 508,000 vehicles, which compared with 405,702 built in November and 418,317 in December, 1935. It was the second month of 1936 to cross the half-million mark, the other having been April. These were the only two months to attain that level since 1929. It broke the highest previous December production record by a wide margin. This makes production for the full year 1936 figure in excess of 4,600,000 units, which had been the top forecast of recent months. Estimated 1936 production of 4,690,000 units compares with 4,119,811 in 1935, or a gain of nearly 12 per cent.